MODERN PLASTICS

April 1958

Are you up-to-date on electronic welding? *page 85*

The fabulous new polycarbonate resin *page 131*

Plastics' stake in agriculture page 91

Where do you need high impact strength at low cost? These nuggets of sisal-filled Durez 18683—black or natural—can give it to you.

New! Low-price phenolic molds high-impact parts

Now, for the first time ever, you can mold high-impact phenolic parts *with a low-priced material*—Durez sisal-filled 18683!

Costing only pennies more than wood-flour-filled compounds, Durez 18683 gives you dimensionally stable parts that have an impact strength of 1.4 ft. lb./in.—and give excellent results in high humidity tests.

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Where else can you use 18683?

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Don't freeze the cost of your high-impact parts until you've seen what 18683 can do for you. To get an evaluation sample and prices, write today on your business letterhead.

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PLASTICS DIVISION

HOOKER ELECTROCHEMICAL COMPANY

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Catalin STYRENE ... in a chopper that topped a million!

This all-purpose household food chopper cut a slashing figure in the housewares field in 1957, for during that year Popeil Brothers, Inc., its designers and developers, shipped more than 1,000,000 Chop-o-matics! *

Open at the bottom for direct action on any wooden chopping board, the versatile appliance has proven its immediate and compelling appeal to housewives throughout the country by preparing quickly, for many needs, a wide variety of foods — vegetables for succulent salads and slaws; fruits and nuts for cakes and sweets; meat and fish for appetizing sandwiches and leftovers.

Ingeniously conceived and cleverly engineered, Chop-o-matic required for its three major non-metallic parts a plastic that was *rigid, tough* and *crystal-clear*. General-purpose CATALIN STYRENE met these requirements admirably and was chosen as the logical material for molding this convenient, lightning-fast housewife-pleaser.

The virtue of versatility belongs not only to Chop-o-matic but also to the molding compound ... for CATALIN STYRENE, the *gem of plastics*, in many other fields of new product design has established its worth — function-wise and cost-wise.

Write now for our new Comparative Properties Chart. In easy reference form it lists the qualities of the complete range of CATALIN STYRENE molding and extrusion compounds. Inquiries invited.

* *"Chop-o-matic" plastic parts are custom molded for Popeil Brothers, Inc. by Artag Plastics Corp. and L. T. Kinder Plastics, Inc. . . . all of Chicago, Ill.*

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In addition to Styrene, Polyethylene and Nylon Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, and Melamine Resin formulations

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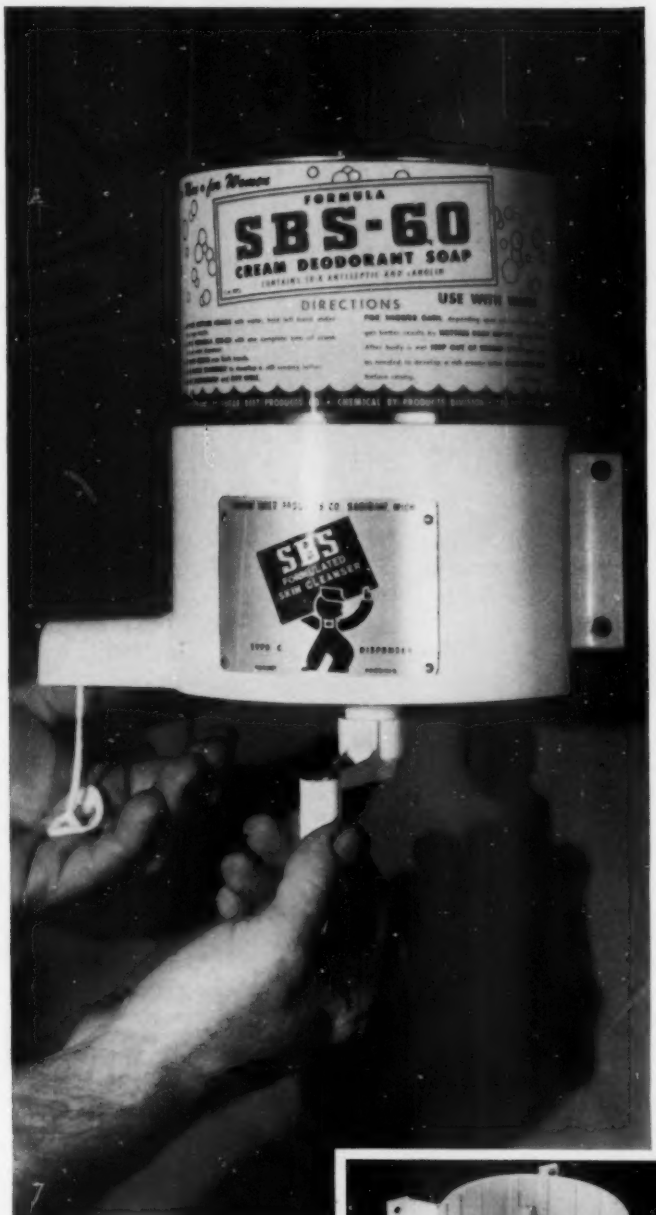


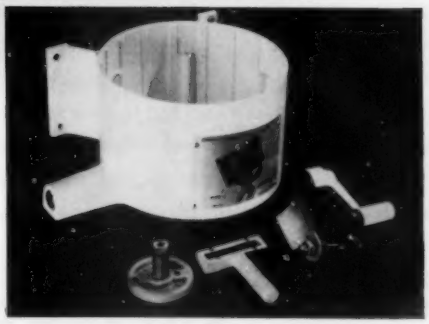
rigid Geon vinyl makes it rugged, rust-proof and attractive

For good looks, durability and cost savings, too, these soap dispensers for plant and office washrooms are made of high impact rigid Geon vinyl.

These dispensers are durable—they resist breakage—and they won't rust, corrode or react chemically with the soaps they dispense. Total cost is less, since no finishing or painting is required, and colors can be molded in the material.

Rigid Geon is also used for piping, fittings, and extruded shapes. Foam Geon makes cushions and safety padding. Protective coatings for steel, paper, upholstery and flexible wire insulation, too, are made from versatile Geon polyvinyl materials.

For technical information on Geon, write Dept. LE-4, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



Soap dispenser housing, crank, plunger, plug and disk are polyvinyl compound molded of rigid Geon by Tube Turns Plastics, Inc., Louisville, Kentucky, for Sugar Beet Products Company, Saginaw, Michigan. Rigid Geon compounds are supplied by B.F.Goodrich Chemical Co.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

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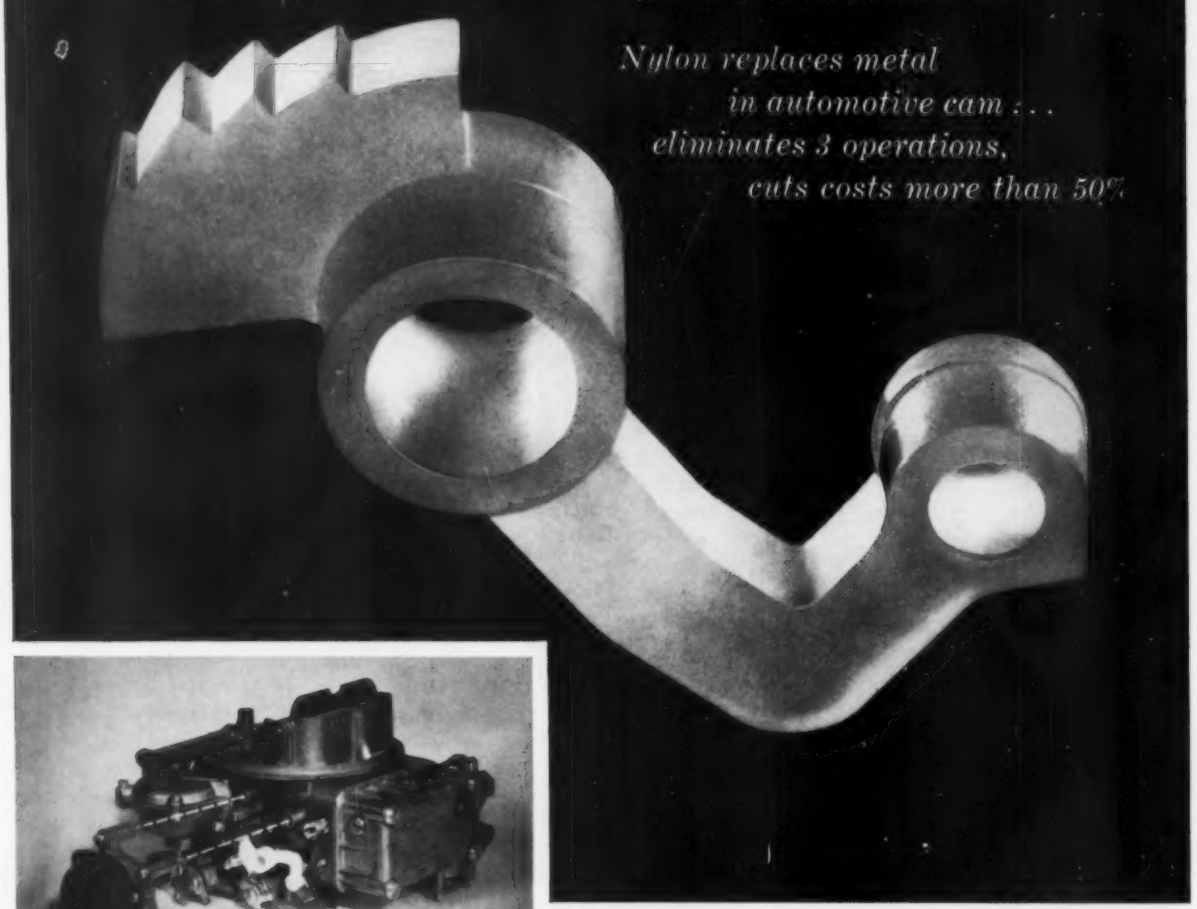
Here's the new nylon idling cam produced by Chicago Molded for Holley Carburetor



Nylon replaces metal in automotive cam . . . eliminates 3 operations, cuts costs more than 50%

Many models of Ford Motor's Lincoln, Mercury and Edsel are equipped with latest-type Holley automatic carburetors. In inset photo, choke housing has been pulled away to show the molded nylon fast-idle cam as assembled.

This nylon fast-idle cam made by Chicago Molded for Holley offers less friction, and resists wear better than cams of low carbon steel. Furthermore, injection-molding it of nylon eliminates three operations – hardening, stamping, assembly – at production savings of more than fifty percent.

Holley is able to change the cam design without obsoleting the entire mold. That's because Chicago Molded designed a unique multiple-cavity mold made with removable sections. This permits easy changes in the number and sizes of the ratchets with very little expense, when the basic part is redesigned.

Designing and making molds that cut costs – and allow for low-cost changes – is a specialty of Chicago Molded's engineering staff. Why not find out if they can cut your costs? Ask, too, for a free subscription to *Plastics Progress* – the data-packed magazine on new developments in plastics. Write:

CHICAGO MOLDED
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2721 North Kolmar Avenue, Chicago 51, Illinois

Editorial

Confusion compounded!

Our editorial in the August 1956 issue of MODERN PLASTICS was entitled "Chaos in the premix market" and exposed a serious situation in lack of standards and data. Chief reference was to the polyester-fiber molding compounds.

Now, a year and a half later, when we have reinforced phenolic molding compounds, polyester alloy reinforced compounds, and other resins becoming involved, we must sadly and even angrily report that chaos has been but compounded!

The properties of a given reinforced molding compound of any kind will depend upon the resin used, its viscosity and flow properties, its rigidity or softness in cured form, its molecular weight, the type and quantity and finish of the reinforcement used, and, to an extent that is too little recognized, on the inert fillers, which are the lowest-cost components, but possibly the trickiest.

There are today hundreds upon hundreds of polyester resin formulations, hundreds of phenolic resins for reinforcement, and probably thousands of alloy possibilities. Multiply these by the various types and quantities of reinforcement material, by catalyst combinations, and by the number of fillers available and you have not hundreds but hundreds of thousands of possibilities—possibilities for good products or for dogs.

As we have pointed out before, these new reinforced compounds theoretically should lend themselves to automation in molding. And since they are thermosets, mistakes are mighty expensive. Molders advise that the translation of test data from laboratory dog bones to molded pieces is virtually impossible. Batch compounding is causing wide variance in properties of even similar formulations. Do-it-yourself compounding in captive and custom plants (a natural evolution in a chaotic situation) is producing weird results.

Surely a few leaders in this field could sit down together, draw up a chart of their main compounds and the properties thereof, compare compound with compound in end-use properties and standardize those which honorably compare with each other. If we could get only a dozen or so that could be produced regularly and that could be specified by molder or end user, we would at least have made a start toward getting sense out of confusion.

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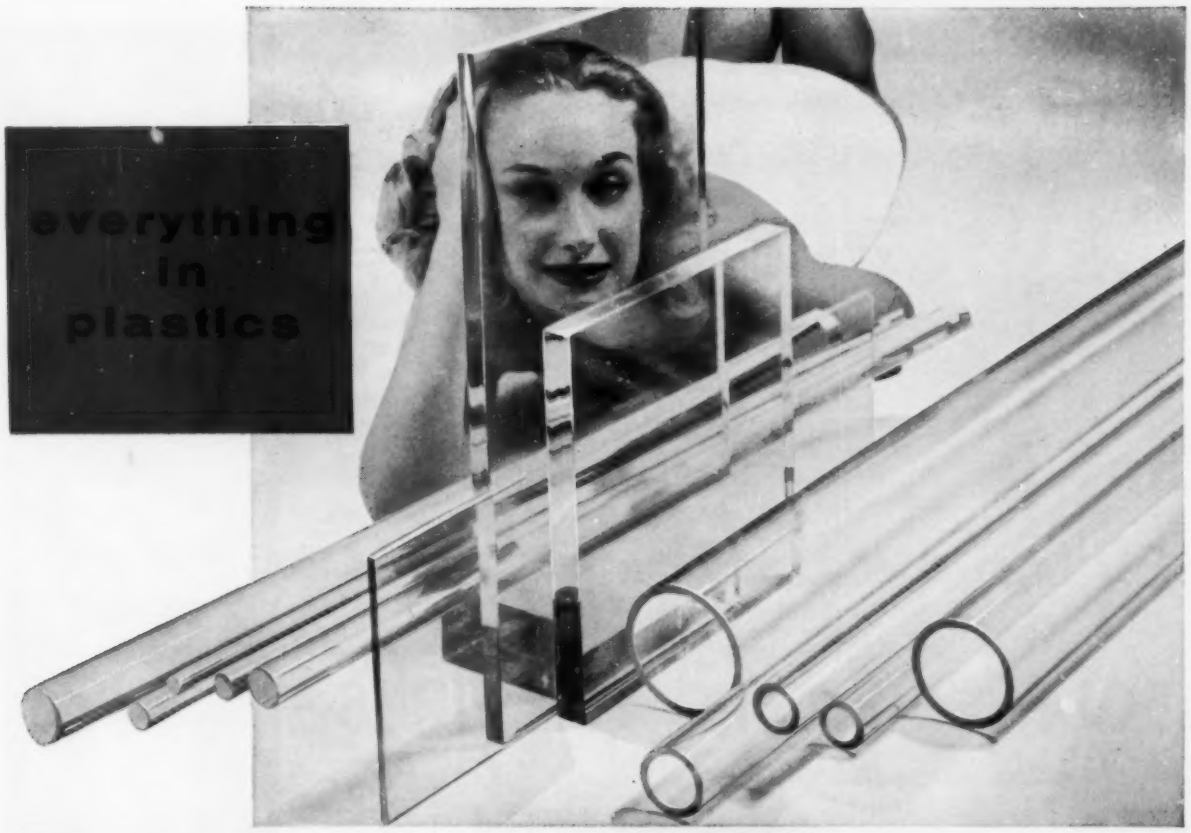

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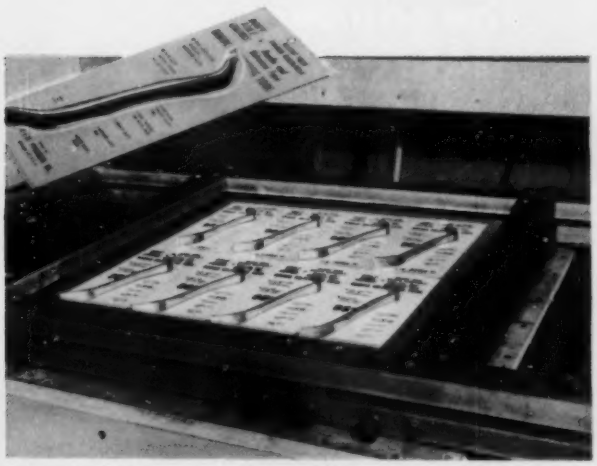

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ELONGATION %	30	25	20	15	12
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SOFTENING TEMPERATURE °F	260	260	260	260	260
TENSILE STRENGTH 20 in. min, psi	4400	4400	4400	4400	4400
STIFFNESS psi	150,000	150,000	150,000	150,000	150,000
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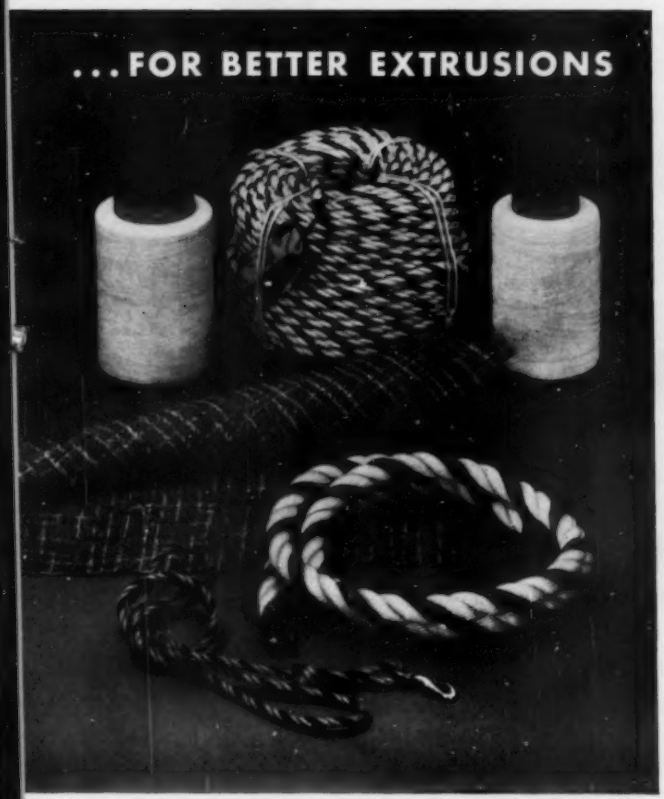

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If you vacuum form parts, you will appreciate the high melt strength of this new resin type because it minimizes sag. Large sheets are accurately formed with uniformly thick walls even in deep draw applications. The high melt viscosity of Type 2 MARLEX is also very useful if you extrude or calender sheet.

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If you would like a bulletin with further information on Type 2 MARLEX resin, please send coupon below. Or call your nearest MARLEX office.

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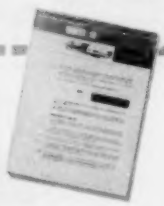

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Name:_____

Position:_____

Firm:_____

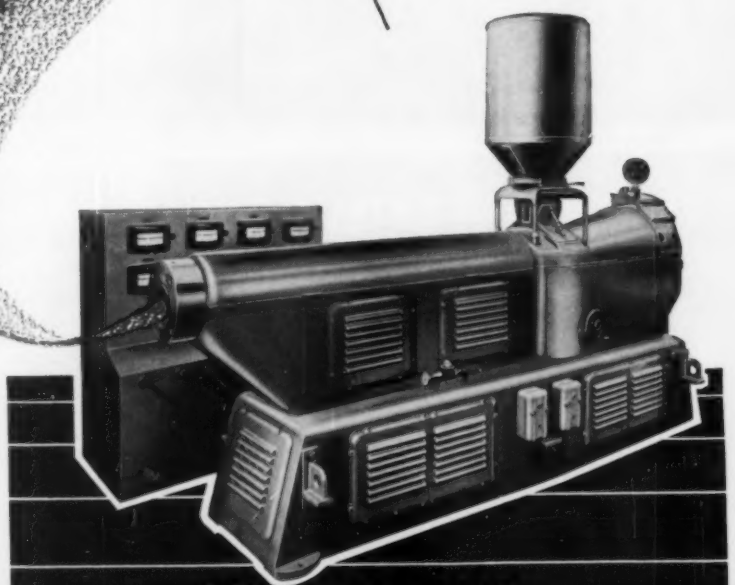
Street:_____

City:_____ **State:**_____

Thinking about EXTRUDERS

Here, perhaps, is just the machine to suit your particular requirements . . . the Windsor 4½", single-screw extruder is designed for high speed production in thermo-plastics and incorporates the following features:

Hydraulic variable drive with control
Independent zone controlled heating and cooling on barrel
One-piece barrel
Barrel heating by induction
Easily detachable die adaptor
Flood lubrication
Thrust assembly designed to withstand 75 tons.
Robust construction, totally enclosed.



4½" SINGLE-SCREW EXTRUSION MACHINE
for thermo-plastic materials

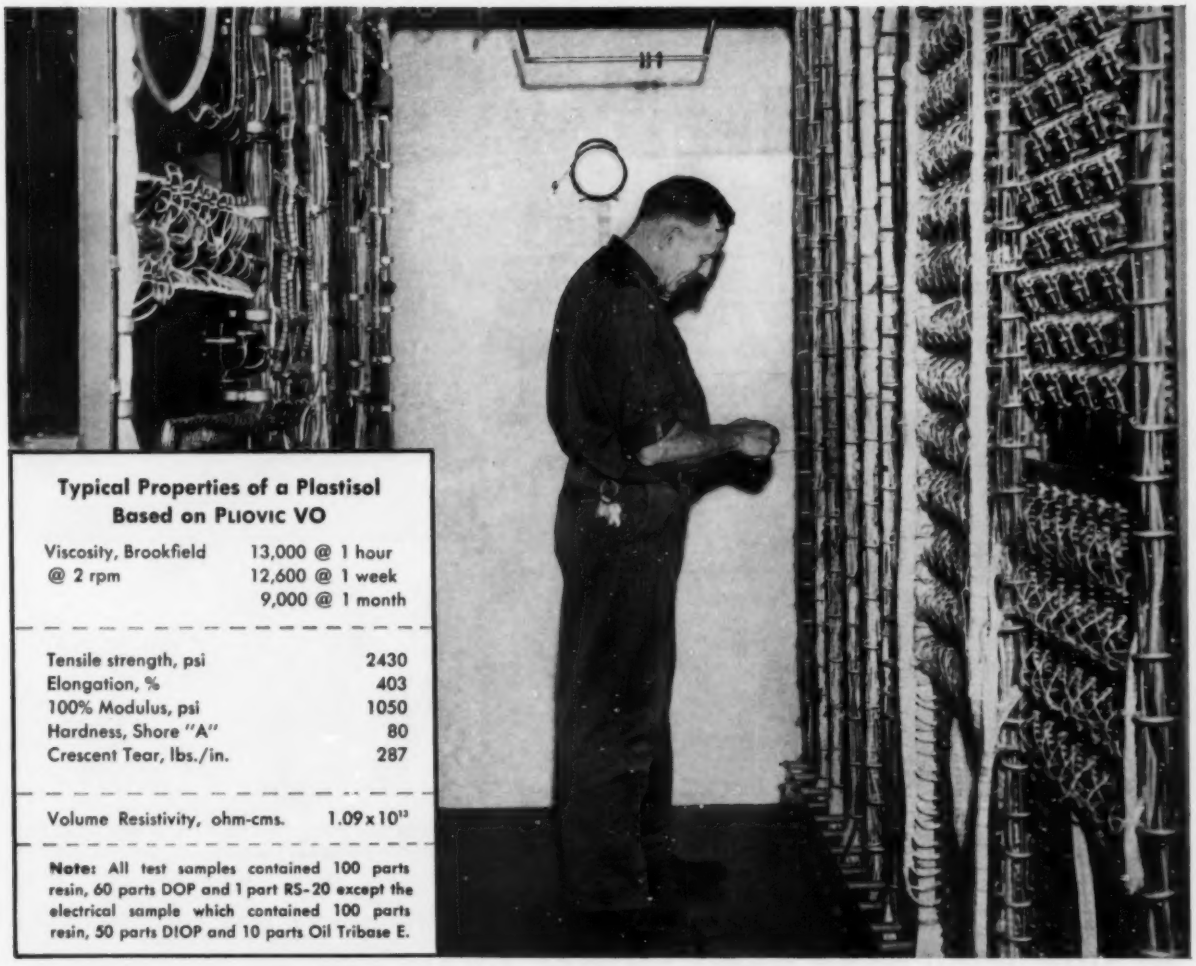
The staff of our newly formed subsidiary, R. H. Windsor of Canada Limited at 56, Advance Road, Toronto 18, Ontario, Canada, Telephone BEImont 2-2971 are at your disposal to supply information regarding Windsor machines, spares and servicing.

R.H. Windsor LTD

Descriptive literature on our full range of machines is available on request.

Head Office and Works:
LEATHERHEAD ROAD • CHESSINGTON • SURREY • ENGLAND

London Office: 49 Upper Brook Street, London W.1. England.



Typical Properties of a Plastisol Based on PLIOVIC VO

Viscosity, Brookfield @ 2 rpm	13,000 @ 1 hour 12,600 @ 1 week 9,000 @ 1 month
Tensile strength, psi	2430
Elongation, %	403
100% Modulus, psi	1050
Hardness, Shore "A"	80
Crescent Tear, lbs./in.	287
Volume Resistivity, ohm-cms.	1.09×10^{13}

Note: All test samples contained 100 parts resin, 60 parts DOP and 1 part RS-20 except the electrical sample which contained 100 parts resin, 50 parts DIOP and 10 parts Oil Tribase E.

New—and purely superior!

If you're looking for something new and different in dispersion resins, particularly for use in electrical applications, you can stop right now. For in new PLIOVIC VO, we have just that.

PLIOVIC VO is a straight polyvinyl chloride resin of exceptional purity. It is designed and made for use in plastisols and organosols for electrical applications, for rotational and slush molding, for metal coatings and for dip coatings.

Compounds based on PLIOVIC VO exhibit the following characteristics: 1. Extremely low initial viscosity. 2. Outstanding shelf stability. 3. Superior electrical properties. 4. Excellent heat stability. 5. Good physical properties. 6. Exceptionally low water absorption. 7. Good film clarity.

Plastisols made with PLIOVIC VO are effectively protected against heat and light with small amounts of economical zinc-type stabilizers. They also are readily deaerated to assure uniform cross sections. And they exhibit a very desirable, dry, nongreasy feel. For full details, including the latest *Tech Book Bulletins*, on the new PLIOVIC VO, the unique PLIOVIC AO, or their blends, just write to: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMIGUM
PLIOFLEX
PLIOLITE
PLIOVIC
WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

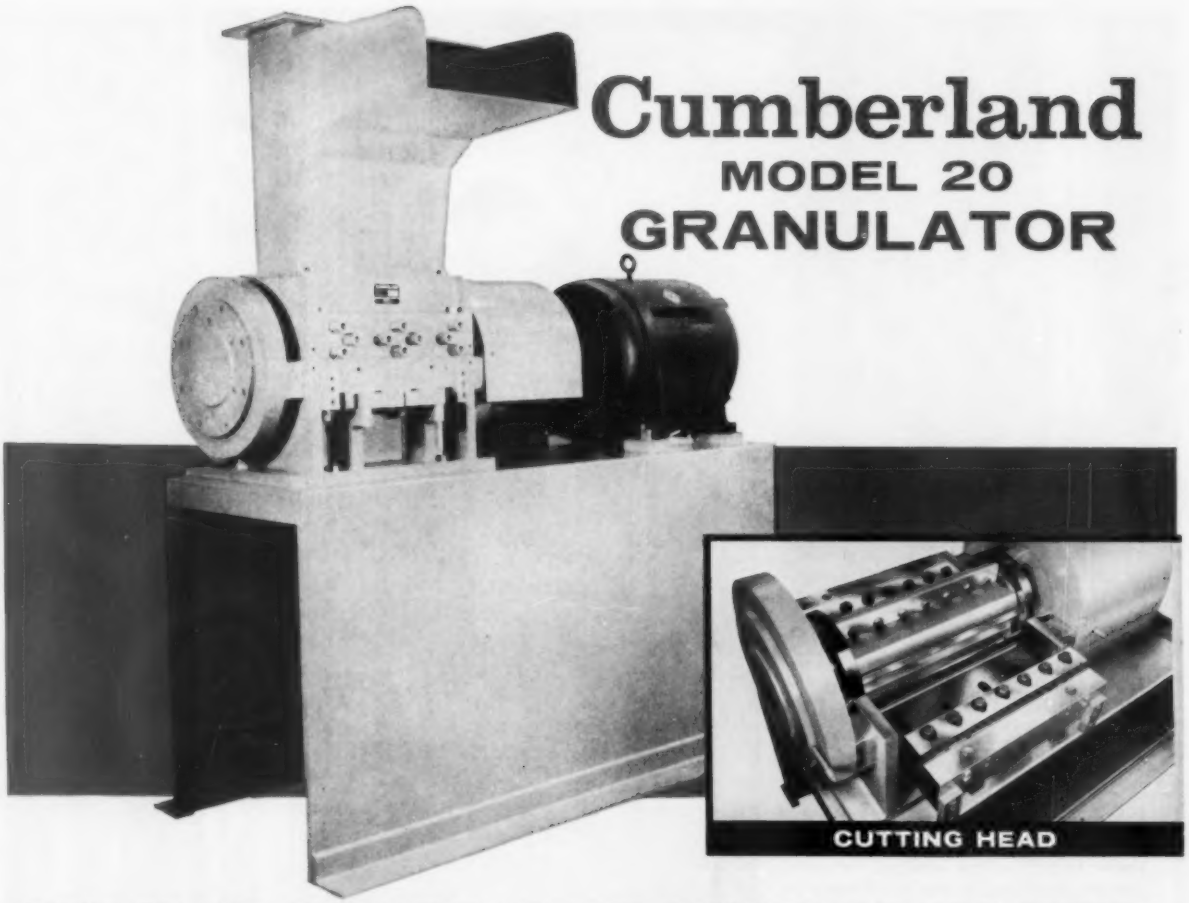
CHEMICAL
GOODYEAR
DIVISION

PLASTICS
DEPARTMENT

60 GOODYEAR

Chemigum, Pliolite, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Cumberland
MODEL 20
GRANULATOR



PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS

LARGE THROAT OPENINGS – 9" x 20"
– 12¾" x 20"

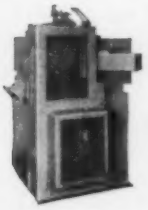
SUPERB CONSTRUCTION – heavy steel weldments with deep welds. Rotor and seal rings are heat treated to provide tough undamageable parts, and ground all over to achieve extreme dimensional accuracy and balance.

VERSATILITY – handles chunky parts of toughest plastic materials such as bleeder scrap, cylinder purgings and heavy slabs of thermoplastic materials. Special adaptors for handling long lengths of pipe such as kralastic, high impact vinyl and polyethylene.

Watch future ads featuring other outstanding Cumberland machines and write for Bulletin 260

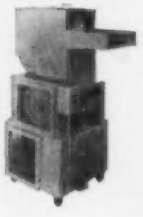
STAIR STEP DICER

Perfect cubes or pellets 1/16" to 1". Two standard sizes accommodate up to 7" and up to 14" ribbons.



BESIDE THE PRESS GRANULATOR

Two new models. Throat sizes available:
8½" x 12"
12" x 16"
10" x 10"
6" x 10"
6½" x 8"



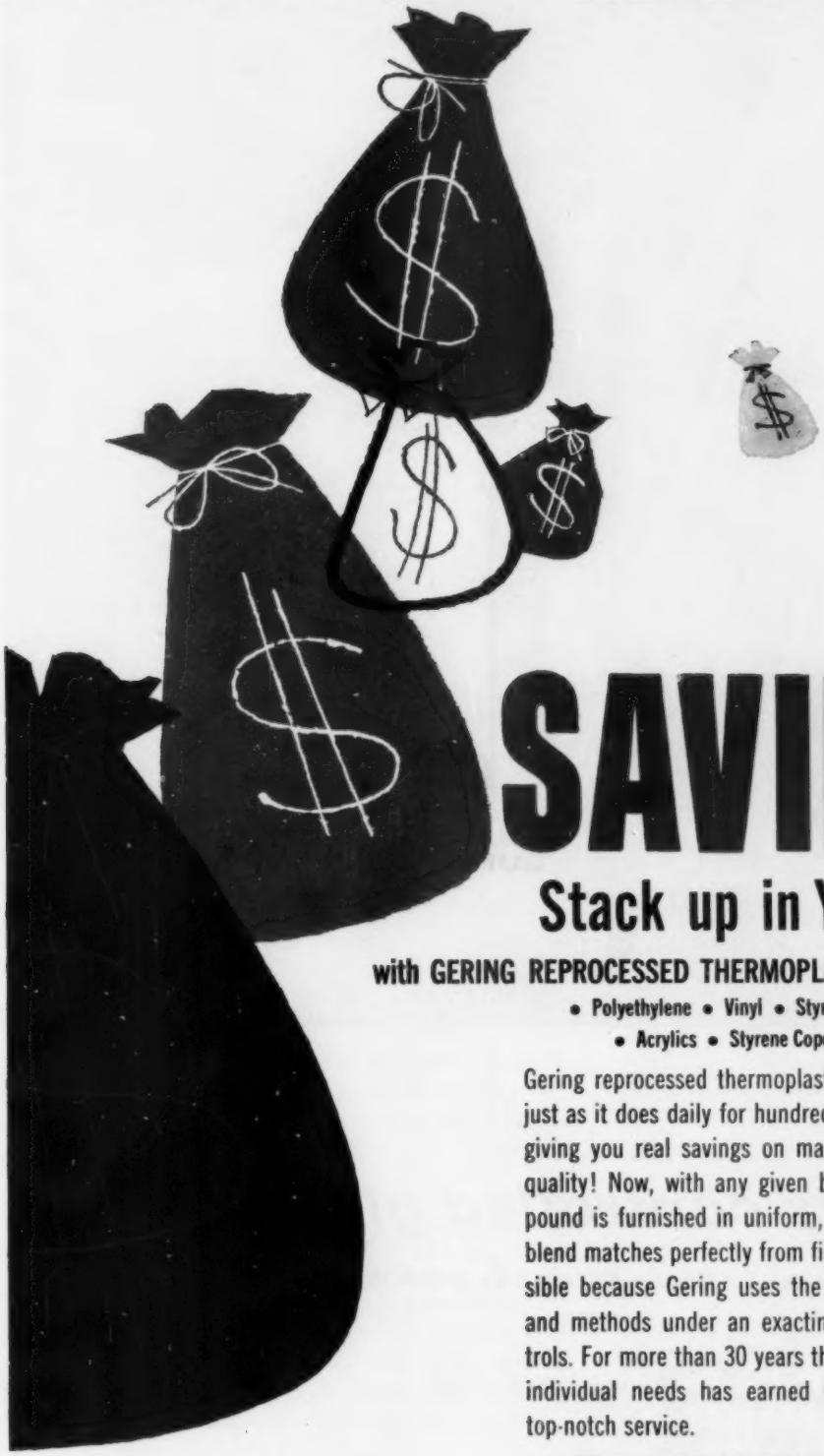
Cumberland
ENGINEERING COMPANY, INC.

DEPT. 1 • BOX 216, PROVIDENCE, RHODE ISLAND
California Representative: West Coast Plastics Distributors, Inc.
8510 Warner Drive, Culver City, Calif.

FOREIGN LICENSEE — Burtonwood Engineering Company, Ltd., Burtonwood, Warrington, Lancashire, England—Sole Manufacturers and Distributors outside North and South America.

917-7

GERING—FIRST CHOICE FOR QUALITY AND CUSTOM TAILORED MOLDING COMPOUNDS



SAVINGS

Stack up in Your Favor

with GERING REPROCESSED THERMOPLASTIC MOLDING COMPOUNDS

• Polyethylene • Vinyl • Styrene • Acetate • Nylon
• Acrylics • Styrene Copolymers • Butyrate

Gering reprocessed thermoplastics can cut your costs—just as it does daily for hundreds of leading molders—by giving you real savings on materials without sacrificing quality! Now, with any given blend, your molding compound is furnished in uniform, dust-free pellets and the blend matches perfectly from first bag to last. That's possible because Gering uses the most modern equipment and methods under an exacting system of quality controls. For more than 30 years this response to customers' individual needs has earned Gering its reputation for top-notch service.

Special offerings of high quality reprocessed thermoplastics are announced through a new bulletin service. We'll be glad to send these money-saving notices to you. Just send us your name.

GERING
Molding Compounds

Gering Products, Inc., North 7th St. & Monroe Ave., Kenilworth, N.J. • Sales Offices: 5143 Diversey Ave., Chicago 39, Ill. • 424 Chevy Chase Rd., Mansfield, Ohio

quality controlled glass fibre

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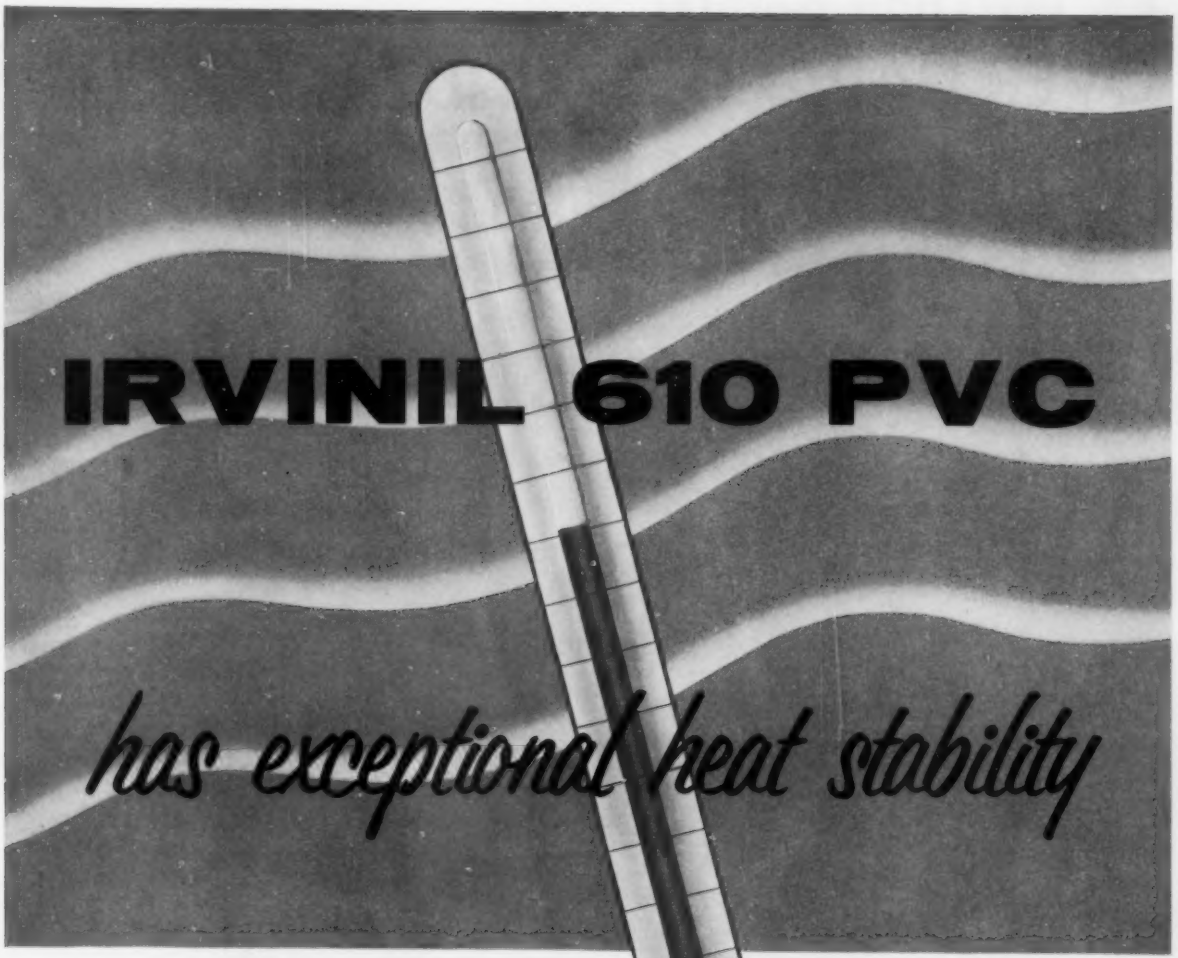
deeglas to B.S.600 & B.S.600R

GLASS YARNS & DEESIDE FABRICS LIMITED

Kingsway Chambers: 44-46 Kingsway, London, W.C.2 England

Telephone: CHAncery 7343 & 8257



YES, IRVINIL 610 PVC, a general purpose high molecular weight polymer, has truly superior heat stability. But this is only one of Irvinil 610's outstanding compounding properties. Additionally, it offers you toughness, excellent light stability, extremely low "fisheye" content and superb dry blending properties.

Needless to say, you *know* how important these qualities are in dry blend extrusion, calendering and injection molding.

Remember, too, that Irvinil 610 makes processing easier and products better because of these other noteworthy unusual qualities: uniformity, excellent color retention, high bulk density, fine dielectric properties and inertness to water, dilute acids and alkalis.

Irvinil 620 PVC

A medium molecular weight resin, Irvinil 620 was developed especially for calendering applications requiring a *softer resin* than Irvinil 610. All the fine qualities of Irvinil 610 also hold true for this resin.

* * *

As part of its overall services, Great American Plastics creates special resins and special compounds designed to meet individual needs. Send today for complete data on our Irvinil Resins and full information on our friendly technical services. GREAT AMERICAN PLASTICS COMPANY, 650 Water Street, Fitchburg, Mass.

IRVINIL Resins

GREAT AMERICAN PLASTICS COMPANY

PACING PROGRESS IN PLASTICS SINCE 1945

MR. INJECTION MOLDER!

OVER CAPACITY or UNDER CAPACITY

Standardize

with IMS **HEATING CYLINDERS**

- **UNIFORM LOW-COST NOZZLES** use rugged 1¾"-8 thread.
- **UNIFORM HEATER BANDS** 4, 6½, 8, 9¼ and 10½. In stock at all times.
- **UNIFORM PERFORMANCE** regardless of press make or model. Cylinders engineered to fit your machine.
- **UNIFORM WALL SECTIONS** uniform heat transfer — uniform heating — no hot spots — no place for plastic to hang up — positive joint seal!
- **PROVEN** in nearly 1000 installations on every make and model of injection machine.

Send for our Heater "How Book" today. It tells about the men and materials that combine to give you IMS Standardized Design Replacement Heating Cylinders.

PROMPT DELIVERY!

IMS offers 2½ to 3 weeks delivery on Quality Replacement Heating Cylinders, engineered to meet your requirements.

More Capacity? Less Capacity? Nylon Shut-off Type—Mixing Type? Vinyl? Write Today!

Cut your press downtime — cut your maintenance costs. Have your foreman send us the few simple measurements we need to build a Uniform Design Heater for your specific press. Do it NOW!

INJECTION MOLDERS SUPPLY CO.

3514 LEE ROAD • WYoming 1-1424 • CLEVELAND 20, OHIO

H-P-M 12/16 oz. machine molding 1" Canco nozzles with 40 cavity mold.

HPM

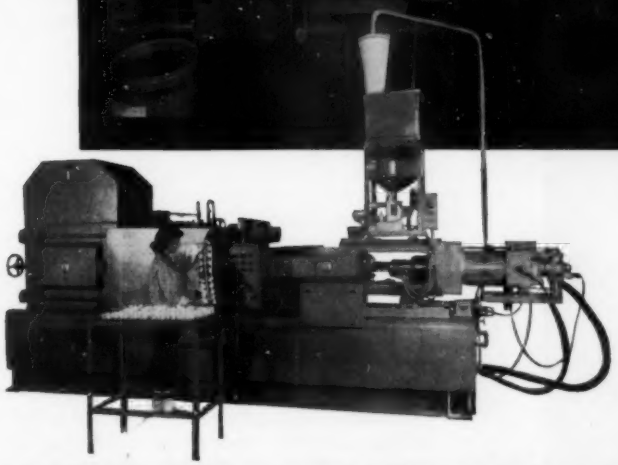
AT PITTSBURGH PLASTICS CORP.

Ten H-P-Ms Help This Company Grow

Constantly "on the move" since it started in business several years ago, Pittsburgh Plastics Corp., a Subsidiary of American Can Co., has been a user of H-P-M injection machines since its beginning. And, we are proud to say, it has continued to order H-P-M machines as it expanded. For molding packaging items, toys, and the wide variety of custom molding jobs handled by Pittsburgh Plastics, H-P-Ms have proven themselves to be good production machines.

Why not take a tip from this well-known molder and help make your molding business grow with H-P-Ms . . . there's a machine for every molding requirement.

A battery of H-P-Ms in one section of Pittsburgh Plastics' modern plant



Write today for information on versatile H-P-Ms . . . machines designed to give larger capacities . . . faster cycles . . . fewer rejects . . . big savings in production costs.

H832

HPM

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

Proof: Styron 475 lends itself to good design, low production costs

ANSWERS EVERY REQUIREMENT. The designer of this electric can opener took advantage of the many excellent characteristics of Styron® 475M. Used for the housing, flip-up lid and push button, this popular Dow hi-impact plastic resists abrasion and food stains. It provides good electrical properties and a long-lasting, easily cleaned finish in a wide range of colors. Styron 475M products like this can be economically injection molded.

COLOR, STYLE APPEALS. Good design combines rich color and smart styling in this slide viewer made of Styron 475. This versatile Dow hi-impact polystyrene offers strength, lightness and durability in an almost unlimited choice of colors. Designers and production men alike find Styron 475 keeps costs and technical problems to a minimum.

Tough new plastics and dramatic processing developments are making product news almost every day. Designers are forging ahead with ideas that would have been impractical only a few months ago. It will pay you to keep abreast of the continuing developments in plastics. For up-to-the-minute information, call the Dow office near you or write to us. THE DOW CHEMICAL COMPANY, *Midland, Michigan—Plastics Sales Dept. 1514B.*

YOU CAN DEPEND ON DOW

another word for

PLENCO

To assure molded products that are cool to the touch . . . gleam with good looks . . . resist wear as well as rust as well as shock as well as acids and grease . . . the exceptional value of *phenolic* molding compounds to the appliance industry has long been demonstrated.

Designers and molders have learned to handle the problem with ease and economy. To handle with confidence in the uniquely ideal properties of phenolics . . . bred to withstand the rigors of life in kitchen and laundry room. To handle, in more and more instances, with *Plenco*.

Appliances, of course, cover a lot of territory. But so do Plenco resins and the services of Plenco engineers. In the variety, versatility and quality-controlled excellence of Plenco phenolic molding materials, industry men in all fields find the answer to their most demanding requirements.

You should find it well worth while to consult with our technical staff.

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and compounds

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

To prevent moisture and dust from entering automobile light sockets, a **chem-o-sol** was specially formulated for an economical high-speed dipping process (no costly molds required). It provides a tough, flexible coating. *(Watts Electric & Mfg. Co.)*

To resist corrosion, drums, tanks, and other large irregularly-shaped objects are sprayed with a structurally strong **chem-o-sol.** Cost savings of up to 35% result, and films of from 5 to 100 mils are possible.

To provide an essential coating for glass yarn used in strong, weather-resistant screening, a **chem-o-sol** with the correct flow properties was produced for economical application by high-speed die-wiping. *(Owens-Corning Fiberglas Corp.)*

To produce a tight seal that is permanently flexible and durable, a specially formulated **chem-o-sol** was tailored for clay pipe joints. A "flowed-in" gasket, it's applied by an in-plant molding process.

What they're doing with

may suggest an easier way to

ECONOMICAL TO APPLY
chem-o-sol ALSO HELPS CUT PRODUCTION COSTS

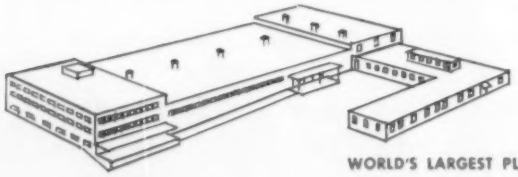
These are just a few of the applications already developed for Chem-o-sol. So versatile is this polyvinyl dispersion . . . so advanced the research, so vast the formulating experience and production capacity of Chemical Products Corporation that Chem-o-sol's product improvement possibilities are virtually *unlimited.*

For Chem-o-sol is more than a coating or molding *compound.* It is a new production tool! Formulated as a liquid without volatile components, it is converted to a strong, resilient solid simply by heating to about 350°F., *without pressure.*

Since each Chem-o-sol formulation is "tailor-made" to best suit the specific requirements of the end use, the formulator's touch is indispensable for translating ideas into reality.

To its practical experience, unsurpassed in point of time or scope, Chemical Products Corporation adds the world's largest and most modern facilities for the development and production of polyvinyl dispersions, including a completely equipped research laboratory to serve you.

IS THERE AN IDEA HERE for improving your own product? Then tell us about the proposed end use of Chem-o-sol.



WORLD'S LARGEST PLANT OF ITS KIND

Chemical Products
CORPORATION
East Providence, R. I.

Member Vinyl Dispersion Division of the S.P.I.

To impart a slip-proof, safety grip and increase wearability of cotton work gloves, palms and fingers are strategically dotted with **chem-o-sol** specially formulated to permit printing on fabrics at high speeds. *(Wells Lamont Corp.)*

To reproduce a natural feel and appearance in bicycle saddles, toys, and artificial fruit, a special **chem-o-sol** was developed. Either slush or rotational casting will produce low-cost articles at high production rates.

To seal the new dry type automotive air cleaner into the car silencer and act as a structural member of the pleated paper element, a **chem-o-sol** was compounded for high-speed molding. Pre-cut gaskets and metal stampings were eliminated. *(Fram Corporation.)*

To improve heat resistance and physical and electrical properties of coatings for flexible sleeving (spaghetti tubing) used in electrical components, a **chem-o-sol** was tailor-made for heat resistance of more than 2000 hours at 225°F.

improve your product

TECHNICAL FACTS ABOUT chem-o-sols

Chem-o-sols possess all the outstanding physical and chemical properties associated with polyvinyl chloride resins. Listed below are some of the properties available in almost any combination.

COLOR CHOICE — unlimited

TENSILE STRENGTH — as required from 1000 psi. to 2700 psi.

PERCENT ELONGATION — 350 to 600

HARDNESS (shore A2) — as required from 10 to 100
(shore D) — up to 65

FLEXIBILITY — to temperatures as low as —65°F

CHEMICAL RESISTANCE — outstanding to most acids, alkalies, detergents, oils and solvents

HEAT RESISTANCE — available to 225°F for as long as 2000 hours and to 450°F for over two hours

DIELECTRIC STRENGTH — minimum of 400 volts per mil when fused in sections 3 mils thick and over

SOLIDS CONTENT — 100%. Chem-o-sols can be molded in very thick sections

VISCOSITY — as required for dipping, die wiping, molding, casting, spraying, or spreader coating

CHEMICAL PRODUCTS CORPORATION
Dept. P-4, King Philip Road
East Providence 14, R. I.

Please send me a free copy of your **chem-o-sol** Brochure.

Name .....

Title .....

Company .....

Address .....

City ..... Zone ..... State .....

Proposed end use .....

.....

Application method .....

.....

Going Plastisols One Better... **chem·o·sol®**

One of four new THERMEX 3R Preheaters shown in foreground. Shown in inset: A textile shuttle made from Formica®.

Growing Formica puts 4 more THERMEX Preheaters on 24-hr. duty

PROGRESSIVE FORMICA CORPORATION, Cincinnati, has recently added four new THERMEX* "3R" Preheaters, bringing their total installation to eight THERMEX units.

Formica estimates that their first four THERMEX units, which have served dependably for about 8 years, give uniform preheating at rates many times faster than the former method. They are expecting their new THERMEX units to serve on a round-the-clock schedule with the same reliability.

Have a THERMEX Engineer study your molding operations to suggest possible ways to cut costs with THERMEX Preheaters. Bulletin T95R4 describes the new Model 3RB unit. Free on request.

*Thermex—T. M. Reg. U. S. Pat. Off.

THERMEX DIVISION
Sales Offices: 76 Beaver St., New York 5, N. Y.
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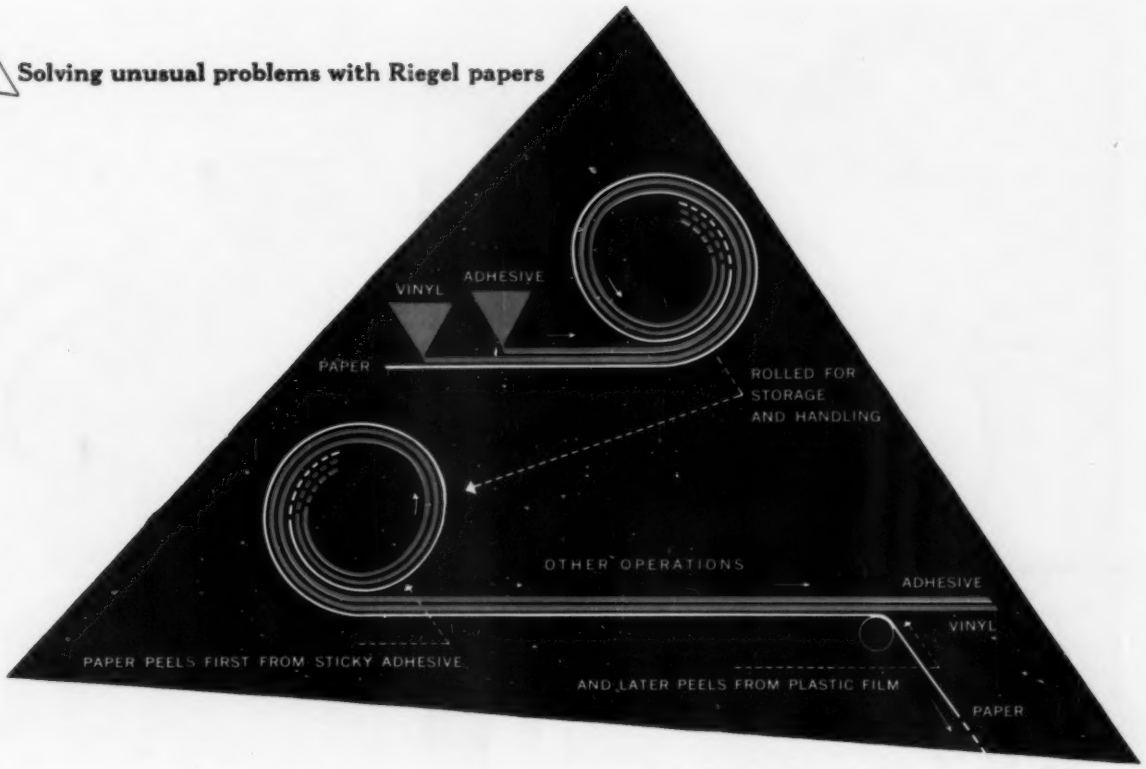
GIRDLER
PROCESS EQUIPMENT DIVISION
NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY
Manufacturers of "VOTATOR" and "THERMEX" Processing Apparatus

Solving unusual problems with Riegel papers



Plastic Casting Paper and Release Paper...all in one!

An idea . . . and a search for a paper that didn't exist . . . recently brought a leading manufacturer to Riegel. Wanted: a paper that would serve as casting paper for plastic film and release paper for pressure-sensitive adhesive . . . *all in one!*

Riegel's developmental team went to work. Drawing on wide experience in plastic impregnations, coatings, and manufacture of unique technical papers, they soon came up with a special release-coated paper that makes the job easy! Here's how it works:

The film of vinyl is continuously cast on the top of the paper and cured at temperatures over 400°F. The paper serves as a carrier while the adhesive is applied to the vinyl. The whole thing, paper, plastic, and adhesive, is then rolled for storage.

Later, when the roll is unwound, the release-coated *back* of the paper peels easily from the sticky adhesive, with such a light pull that the adhesive-coated vinyl film remains on the base paper where it was cast. Yet a few steps later, the plastic itself strips cleanly from the paper. We've named it a *differential* release paper.

Riegel specializes in developing, manufacturing and converting *technical papers that solve problems.* More than 600 kinds . . . many with properties that will intrigue you . . . have already been produced on our 14 paper machines. If you have an idea for doing something in a better way . . . with a better paper . . . write to Technical Advisory Service, Riegel Paper Corporation, Box 250, New York 16, N. Y.

OVER 600 RIEGEL PAPERS

- Release papers for pressure sensitive adhesives
- Casting papers for films, adhesives and polyurethane foam
- Separating papers for plastic laminating
- Interleaving papers for tacky materials
- Resin-impregnated papers
- Heat-seal coated papers
- Laminations of paper, film or foil
- Polyethylene extrusions on paper, film or board

Riegel

TECHNICAL PAPERS FOR INDUSTRY

CONTROL

is half the story of Fellows speed and automatic operation!

'Speed' that counts in lowered costs is assured by Fellows' accurate, built-in controls. The bonus capacity, extra power, faster cycling time of Fellows 3-125 are backed up by controls that minimize rejects, speed set-ups and change-overs, provide truly automatic operation.

All controls are easy to set and check, grouped for maximum convenience. Die height is adjusted and clamped at a single point. Stroke length adjustment is provided for both press and injection ends. Sensitive heat controls hold temperature precisely without difficulty. Optional protective devices eliminate risk of damage for unsupervised operation.

See for yourself how the Fellows 3-125 can cut *your* molding cost per piece. Ask your Fellows Representative for full information. (And ask him about the Fellows Plan for deferred payment.) Contact any Fellows office.

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department: Springfield, Vermont
Branch Offices: 1048 No. Woodward Ave., Royal Oak, Mich. • 150 West Pleasant Avenue, Maywood, N.J. • 5835 West North Avenue, Chi. 39
6215 West Manchester Avenue, Los Angeles 45

Two at a time...

Wastebaskets molded for higher production... lower cost

A major manufacturer of metal housewares decided to broaden his line by adding plastic wastebaskets. His first step was to call in a Nosco sales-engineer . . . logical, because Nosco men are qualified plastic-parts technicians who know exactly how to put Nosco engineering and production facilities to work. The Nosco plant thus becomes the customer's own plastic molding department!

For the 8-quart basket, Nosco engineered *the deepest two-cavity mold ever built.* This hot-runner mold, which virtually eliminates all scrap, weighs more than a ton and is run in one of Nosco's large pre-plasticized presses.

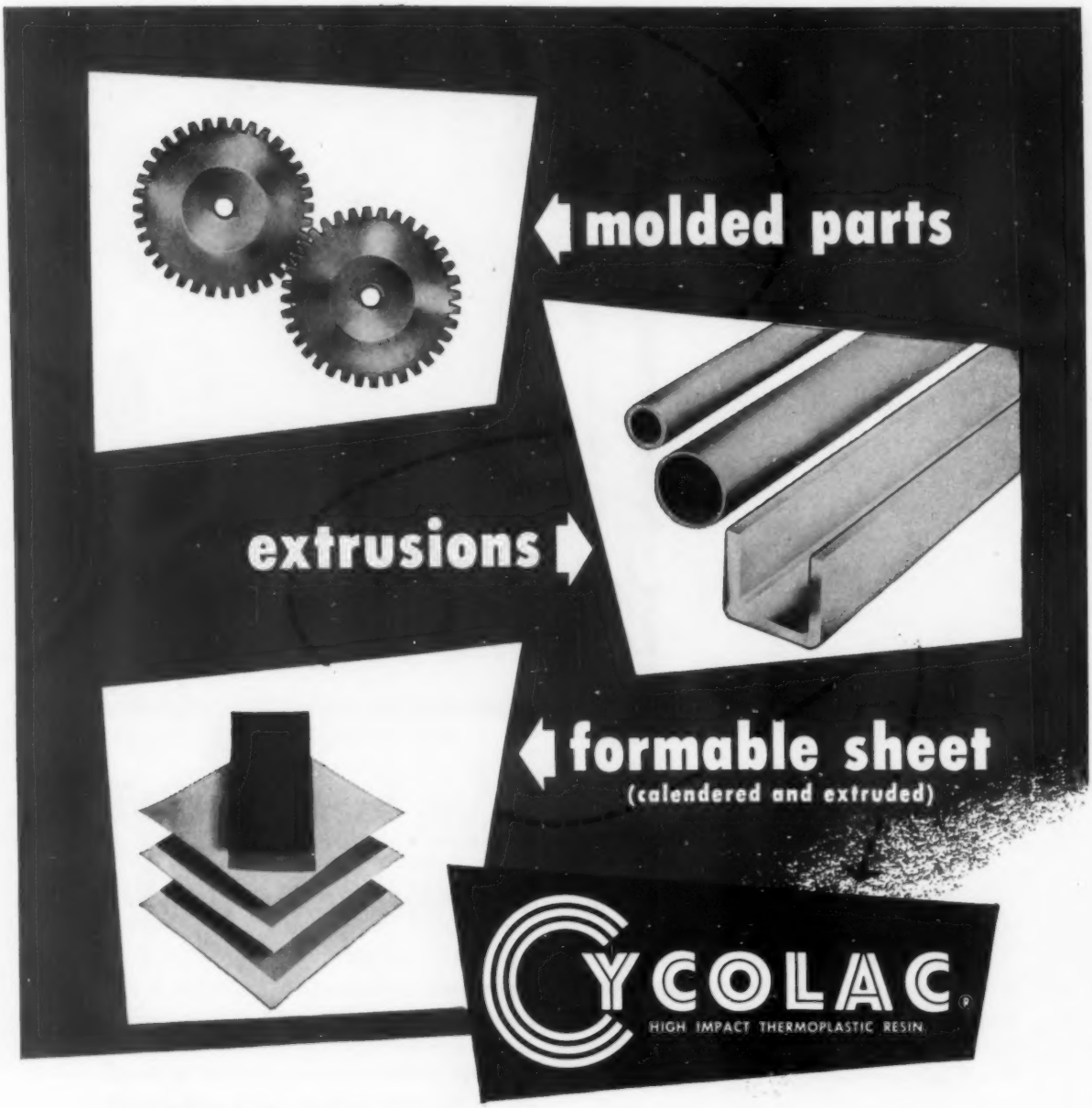
The two larger size wastebaskets, pictured above, are now molded one at a time, but when production warrants, these parts can also be molded in two-cavity dies.

Nosco "Can Do" enabled this manufacturer to successfully produce deep-drawn parts at lower cost. Why not let one of our sales engineers put Nosco "Can Do" to work in designing your next plastic part? Please write.

NOSCO plastics, inc. • erie 4, pa.

World's largest injection molding plant

For other case histories—and for a glimpse of the Nosco plant and facilities, send for the free 12-page brochure, "How the Nosco Plant Works to Produce Your Needs in Practical Plastics."



SOME OF THE 1001 END PRODUCTS MADE WITH CYCOLAC

- Kitchen Accessories
- Molded Pipe and Industrial Fittings
- Signs—Display Cases
- Desk Tops • Luggage
- Appliance and Tool Handles
- Carpet Sweeper Housing and Wheels

Cycolac now offers you five types of resins . . . each designed to serve specific requirements for better molding, extruding or calendering applications. It will pay you to try Cycolac—it may be your simple solution to many product cost and quality problems.

Write for latest technical data today!

PACESETTER IN

Marbon CHEMICAL

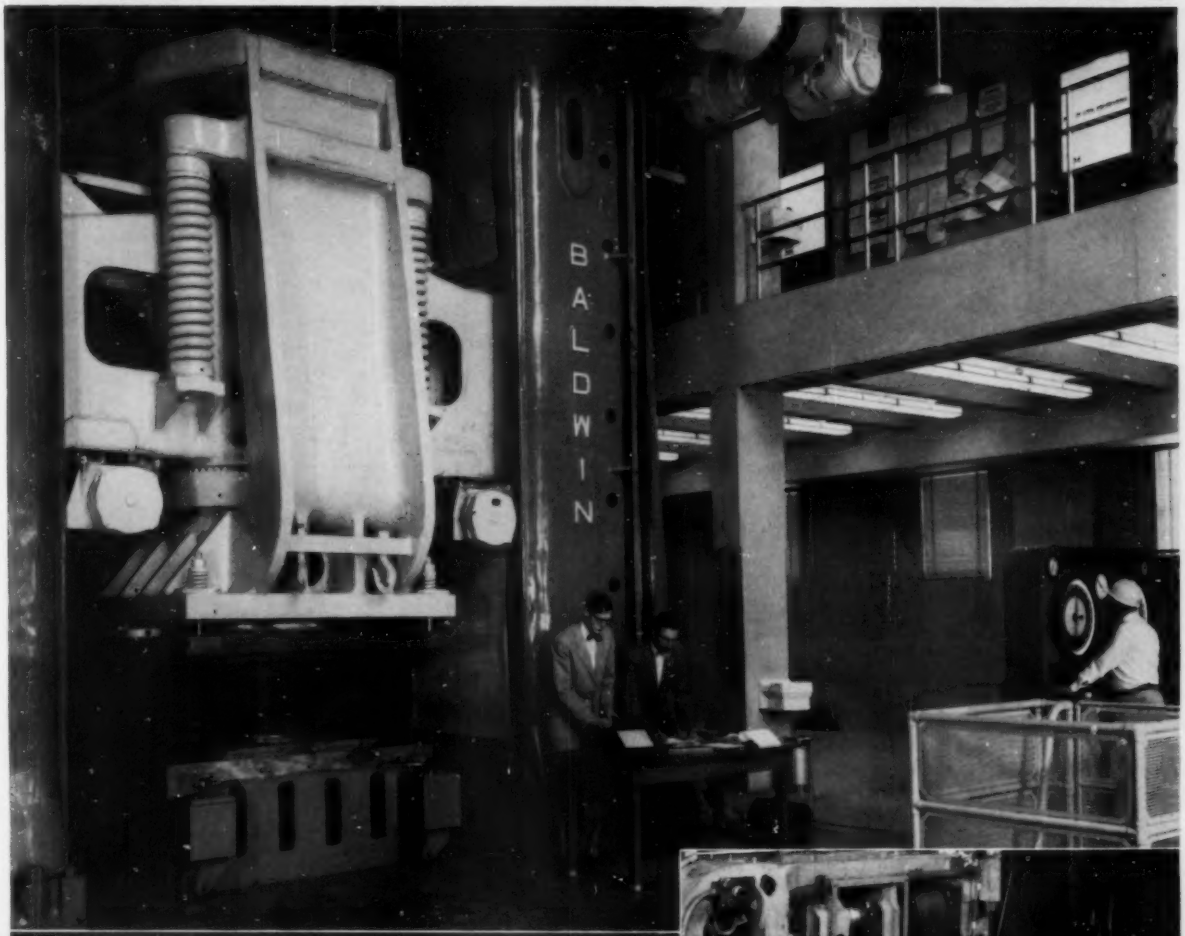
SYNTHETIC RESINS

Division of BORG WARNER • Gary, Indiana

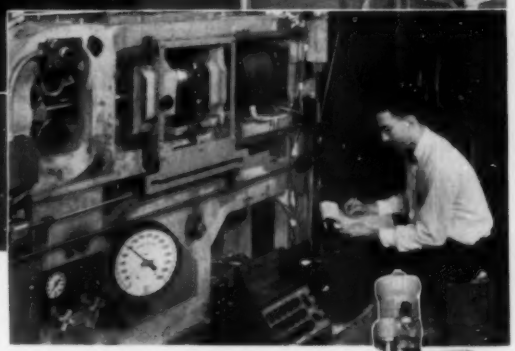
also represented by:

WEST COAST: Harwick Standard Chemical Co., Los Angeles, Cal.
CANADA: Dillons Chemical Co. Ltd., Montreal & Toronto
EXPORT: British Anchor Chemical Corp., New York

A NEW STEP IN LESTER STANDARDS



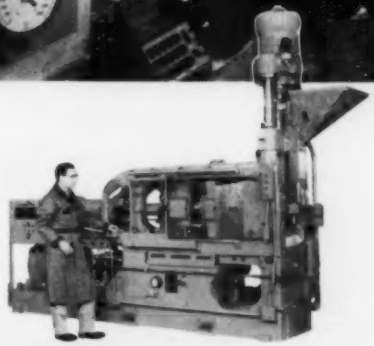
Read how 5,000,000 Lb. University Test Backs Up LESTER Locking Ratings...



A machined ring is squeezed between the jaws of a giant testing machine (capable of exerting 5 million pounds of pressure) at Lehigh University. Readings at various pressures are taken by an independent engineer. This ring is, in turn, locked between the platens of our machines and the comparison readings certify the clamping tonnage.

Why do we do it?

Because we know that the heart of controlling the quality of molded parts is the ability of the machine to develop and *hold* its full rated locking tonnage. Only with the one-piece cast alloy frame, an exclusive feature of Lester machines, is this tonnage assured for the life of the machine. No torque, no twist, no wear, no adjustment. Just rigid, dependable, *certified* clamping tonnage.



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Use Columbian's

COVINYLBLAK®-BA

30% DISPERSION OF NEO SPECTRA® MARK II (carbon black)

in vinyl resin in dry chips

- Eliminates grinding... dirt, labor complaints, equipment maintenance.
- Provides a complete, precisely uniform dispersion... no performance variations from lot to lot.
- Gives utmost jetness, gloss, strength and ultra violet resistance to your finished products.
- Effects economies... a little goes a long way; reduces labor and equipment costs.

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● COLUMBIAN supplies Carbon Blacks in three forms: POWDER — BEADS — DISPERSIONS ●

for the exacting needs of guided missiles

SUNFORM® can be the answer

Light, strong, and able to resist high heats, Sunform – Electro-Tech's latest pre-preg – is spearheading the role of plastics in the new era of space flight.

Now vital in many missile and rocket applications, Sunform may provide an answer to some of your basic problems, too. Electro-Tech's new series of Sunform phenolics, epoxies and silicones meet rigid military specifications–you can be assured of uniformly high quality and performance over a wide range of applications.

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DIVISION OF
Sun Chemical Corporation
113 East Centre Street, Nutley 10, N. J.

In Western United States: Furane Plastics, Inc., 4516 Brazil Street, Los Angeles 39, California.

FOR FREE SUNFORM DATA AND SAMPLES
clip this to your company letterhead and mail today:

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Dept. ES-461, 113 East Centre St., Nutley 10, N. J.

Please send me your free Sunform material.

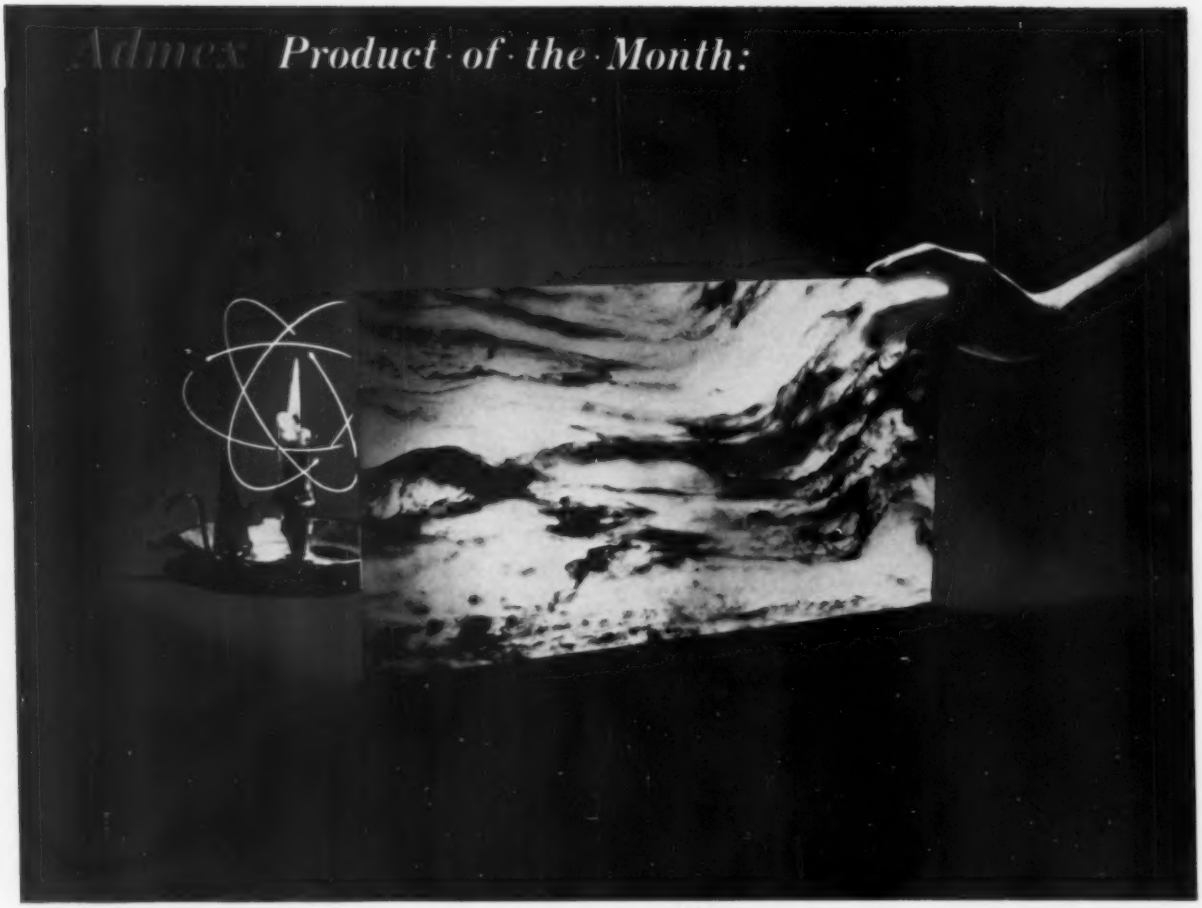
Name_____ Title_____

Firm_____

Street_____

City_____ Zone___ State_____

Admex Product of the Month:



THE *Incredible Beauty* OF POLISHED MARBLE

. . . NEWLY CREATED IN VINYL FLOOR TILE BY ROBBINS

You have to see it to believe it! Robbins Floor Products' new *Pompeiian Marble* floor tile looks like polished marble . . . but is actually pure vinyl. Realistic natural hues and patterns swirl artfully through the clear vinyl, producing the three-dimensional, luminous look of genuine marble. Available in tiles of all standard sizes including 36″ squares which faithfully reproduce a true marble-like appearance, it needs minimum care, quietly absorbs footsteps, springs back when dimpled by furniture.

Pompeiian's 12 light-to-dark marble tones (there's even a gold metallic) are given built-in color stability against heat and light aging by formulating with one of ADM's Admex vinyl plasticizers. See Robbins' remarkable new Pompeiian Marble vinyl tile for a startling demonstration of how well you can formulate with Admex. Or write us for Admex technical data and evaluation samples.

Admex
Vinyl Plasticizers

ADM PRODUCTS: Linseed, Soybean and Marine Oils, Synthetic and Natural Resins, Fatty Acids and Alcohols, Vinyl Plasticizers, Hydrogenated Glycerides, Sperm Oil, Foundry Binders, Bentonite, Industrial Cereal, Vegetable Proteins, Wheat Flour, Dehydrated Alfalfa, Livestock and Poultry Feeds.

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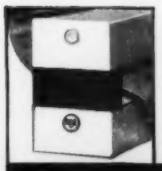
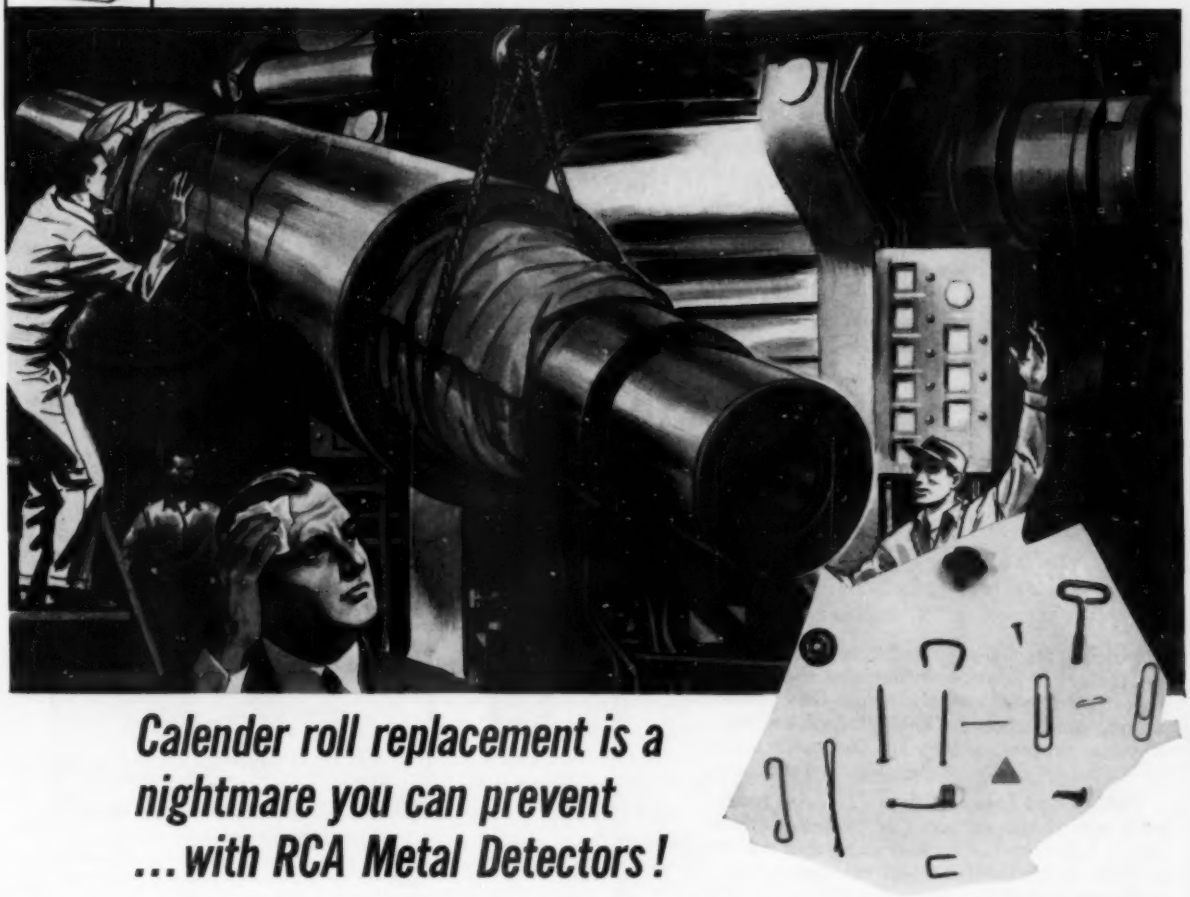
717 INVESTORS BUILDING, MINNEAPOLIS 2, MINNESOTA



...GATEWAY TO SAFETY FROM TRAMP METAL



Calender roll replacement is a nightmare you can prevent ...with RCA Metal Detectors!

If the above picture was only a "bad dream," it wouldn't be worth discussing. Unfortunately, tramp metal damage to calenders DOES cause shutdowns in plastics plants. When this is the case, the loss of production is staggering, not to mention the cost of replacing or regrinding damaged roll! A well-known processor says, "Over the years RCA Metal Detectors have saved us tens of thousands of dollars in detecting foreign matter in our raw products which could damage our calenders. We feel the Detectors are cheap at any price."

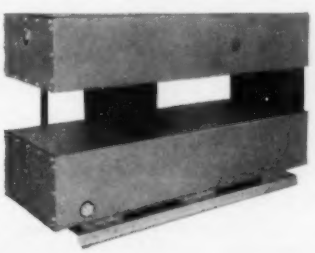
Used on strip material traveling at speeds from 15 to 1000 ft. per min., with full inspection sensitivity, the Detector can be arranged to sound an alarm, and/or stop the traveling material. In plant after plant, the RCA Electronic Metal Detector has paid for itself many times over through increased life of costly machinery, decreased downtime, and savings in product. It can be put to work quickly in *your* plant.

Find out today how the RCA Metal Detector can save you money. Write for latest literature, RCA, Dept. E-75, Building 15-1, Camden, N.J.

Tmk(s) ®

RADIO CORPORATION of AMERICA

CAMDEN, N.J.



RCA ELECTRONIC METAL DETECTOR

EPON® RESINS

. . . *preferred for potting*

If potting, laminating, sealing or encapsulation are factors in your operation, you should investigate Epon resins. Because they provide a unique combination of desired electrical and physical properties, they are finding increased use in many phases of the electrical industry.

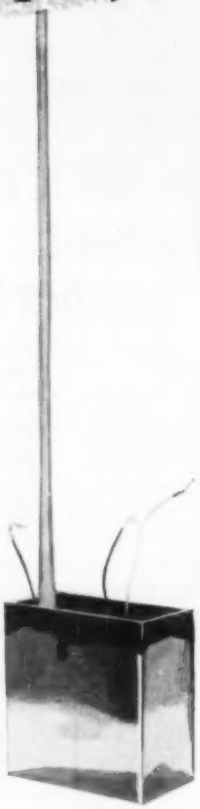
Potting and Encapsulation . . . Epon resins offer remarkable adhesive properties, forming strong bonds to metals and glass, and creating airtight enclosures for sensitive components and vacuum tubes.

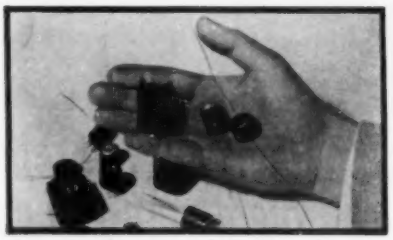
Sealing . . . Epon resin-based compounds are ideal for moisture sealing even at elevated temperatures.

Laminating . . . Epon resin, laid up with inert fibrous fillers, produces laminates with superior dielectric properties and moisture resistance. Epon resin laminates can be dip soldered, sheared, punched and drilled, and provide *excellent dimensional stability.*

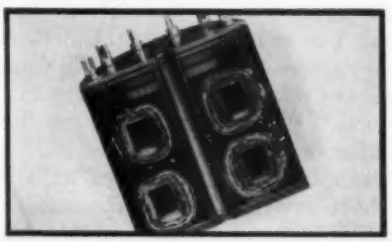
And, solvent-free Epon resin adhesive formulations . . . between glass, metal, or plastic . . . *cure at room temperature with contact pressure alone.*

Can Epon resins solve a production problem for you? For assistance and technical literature, write us now.





These miniature electronic components potted in Epon resin will withstand solder bath temperatures and retain excellent dimensional stability.



Sections of magnetic amplifier coils, when embedded in Epon resin, have exceptional resistance to solvents and chemicals

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SHELL

The Plastiscope*

April 1958

News and interpretations of the news

By R. L. Van Boskirk

Section 1

How does the plastics business look today? There are many executives who insist that sales volume of plastics in 1958 will exceed the record years of 1957 by 8 to 12 percent. But that depends upon who is talking. A melamine representative, for example, is expecting the dinnerware business to keep right on growing—he had a better than usual November and December and the combined January-February volume total was almost as good as a year ago, even though a price increase was initiated in January. However, business is spotty and some dinnerware molders report a serious decline. Acetate and butyrate molding material was near its peak sales volume with nearly 8 million lb. in November and December and is still holding strong. Shoe heels and a return of part of the doll business have been helpful for acetate, but the decline in automotive must have hurt butyrate. The daily operation rate in polyethylene, other than molding material, was continuing to climb in February, even though the total figure for the month may have been down.

But other branches of the industry haven't fared so well. The November and December volume shown on pp. 190-191 indicates the severe drop in plastics other than those mentioned above. It was one of the worst December declines since 1950—and December is a notoriously low month, anyhow.

January is thought to have been up somewhat, but probably not as high as November. February, however, may have dropped to the lowest sales volume of any February in recent years—for some materials even lower than December. February is nearly always below January and March, anyhow, but this last February was a Lulu. March may have bounced back slightly.

Vinyl caught in automotive squeeze. The automotive industry normally uses around 50 million lb. of vinyl chloride a year. It is currently buying vinyl at less than half that rate. Last October was one of the biggest months in history for vinyl—58 million pounds. But the auto industry was then buying for 1958; and when production failed to pick up, buying of supplies declined. In November vinyl chloride sales dropped to 48 million lb., in December to 40 million. Total sales for 1957 may go as low as 630 million instead of the expected 650. Resin for film dropped to 4 million in December, compared with 11 million in October, according to Tariff Commission figures. Resin for textile treatment dropped from around 6 million in October to around 3 million in December. Wire coating is down because of automotive cutbacks and slow buying for construction use. Floor covering, too, is reported off in January and February.

But there are some favorable factors. March may be up 10 percent over February, which is estimated at 40 million lb. or less; and processors are

*Reg. U.S. Pat. Off.

FOURTH OF A SERIES

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. VYGEN

THE GENERAL TIRE & RUBBER COMPANY
CHEMICAL DIVISION • AKRON, OHIO

INTER-OFFICE MEMORANDUM

FROM: Production Superintendent

TO: General Sales Manager

SUBJECT: NEW RAW MATERIALS – VYGEN PVC RESINS FROM GENERAL TIRE & RUBBER COMPANY, CHEMICAL DIVISION

A group of specialized PVC Resins has been run through the lab and through production, with results so good that we thought you should have the details. All four are extremely high quality resins, filling definite needs in our production program, and eliminating many product difficulties which you and I have discussed at length in the past. The following points should aid your sales efforts.

For instance, you can start bringing in orders for light-colored injection molded parts. VYGEN 105 has the necessary heat stability to enable us to run these parts without the previous difficulties, and at the same price. We can also use this resin to produce a very high gloss extrusion, such as the one you proposed last month for one of your big customers.

VYGEN 110 has eliminated the color-drift problem we were having on calendered pastel goods. With this resin we have been able to maintain all shades very well through eight-hour runs.

With VYGEN 120 we are now able to extrude stock 128 from a dry blend. By thus eliminating the pelletizing operation we can make this product very competitive. We have also run stock 823, which has shown excellent electrical properties. This might allow you to develop some new business to keep our line going while established products are in "off seasons".

You might also be interested in the new method we are using to add colors. With VYGEN 161 we make a pigment-plasticizer-resin masterbatch, a much neater, more accurate and economical system. The very high plasticizer absorption of Vygen 161 makes it possible for us now to handle jobs that require large amounts of plasticizers.

Another important point for you to know is that we can get overnight delivery on any of these resins, so rush orders need no longer present such a problem, from the raw material standpoint. The service is excellent and the products are top-quality.

A B Thaxton

Production Superintendent

The Plastiscope

(Continued from page 37)

buying on a quick delivery basis, which should indicate that their big inventories are depleted. The automotive industry directly affects less than 10 percent of the total vinyl chloride business, but there will have to be some big gains in other market areas to overcome the automotive loss if 1958 sales are to equal those of 1957.

Polystyrene and phenolic. After the big October volume of 38 million lb., polystyrene dropped to 32 in November and 28 in December. The year's total wasn't quite 400 million pounds. There is no optimism about what happened in January and February. It's too early to get a good picture for March, but producers are still hopeful for a year's total that will come near 1957. During the recession in late 1953 and early 1954, the monthly rate was generally under 25 million pounds. The phenolic situation was explained in this column last month—a severe decline in November and December after a record month in October caused by a 60 day advance notification of a price raise. January and February haven't shown much increase.

New price for low-pressure-processed polyethylene. A lower price for low-pressure, high-density polyethylene has been in the cards for a long time, but it wasn't expected until this summer. But apparently the industry decided to "speedup" the program and, consequently, the price has been reduced from 47 to 43¢ in natural color for 20,000-lb.-and-over quantities. Black is now 45½¢ and colored is 49 cents. In quantities of 5000 to 19,999 lb., the price ranges from 44 to 52 cents. Price of *conventional,* high-pressure-processed polyethylene is now 35¢ for film and standard molding grades, 32½¢ for high-melt-index molding grade, and 37½¢ for pipe grade.

Phillips, Celanese, Hercules, and Grace are now producing low-pressure polyethylene; Koppers is about ready; and several others are expected to be ready soon. The announced capacity of those mentioned is over 200 million pounds. Estimators guess that less than 10 million lb. were sold in 1957. Producers are hopeful that the new price will encourage molders and extruders to develop new and broader markets—educational and development work carried on over the past year has taught them how to handle the new polyethylene and now the serious business of getting it on the market should progress rapidly. Users have been told time after time that the new polyethylene is not a replacement for conventional polyethylene, but a new plastic that will broaden their market and the new price is expected to help them obtain those markets.

Polystyrene price reduction. A ¾¢/lb. reduction on bag shipments of general-purpose polystyrene in both crystal and color was recently announced by Dow Chemical and quickly followed by other producers. Price is now 24¼¢ for crystal and 27¼¢ for color. Dow also announced discontinuance of three standard color formulations because they were in limited demand. This leaves a total of ten standard colors still available.

The new Dow price list called attention to two new general-purpose

meet Argus' international cousins

Unlike Dick Whittington's cat who went to London just to look at the King, the Argus cat has gone abroad for good business reasons: to satisfy growing world demand for Argus Mark stabilizers and Drapex plasticizers.

Argus has formed a European company with Union Chimique Belge of Brussels, major producer of industrial chemicals. The new company, SA Argus Chemical NV, will manufacture and sell Argus products in 11 European countries.

Along with its products for vinyls that have set new standards for quality, Argus is exporting a tradition — giving customers invaluable help in basic vinyl research and technical field service. European personnel will be trained here by Argus' technical and research staffs.

To serve British and Scandinavian markets, Argus has granted England's second largest producer of plasticizers, Lankro Chemicals, Ltd., of Manchester, the rights to manufacture and sell Argus Mark stabilizers. They will be marketed under the trade name "Lankro Mark."

Whatever the country, whatever the language, whatever your vinyl processing problem, Argus has the answer—or will find it for you.

ARGUS CHEMICAL CORPORATION / 633 Court Street, Brooklyn 31, N. Y.

European Affiliates: SA Argus Chemical NV; 33, Rue d'Anderlecht, Ruisbroek-lez Bruxelles, Belgium — Lankro Chemicals, Ltd.; Eccles, Manchester, England

The Plastiscope

(*Continued from page* 39)

formulations. Styron 666M with improved strength and ease of flow and 689, a particularly easy-flowing formulation with brilliant sparkle and lack of haze. They are modifications of Dow's standard 666 general-purpose formulation.

The price reduction is perhaps symptomatic of the hard selling now going on because of increased competition from other materials and an anticipated leveling-off of markets. It was apparently aimed at so-called "sniping." Price of general-purpose polystyrene has now declined more than 5¢/lb. since July 1956 and the margin between monomer and polymer is becoming pretty thin. It is notable that impact polystyrenes have maintained a steady price structure during the maneuvering that has taken place since the monomer price reduction in July 1957. At the same time, their share of total polystyrene consumption is believed to be increasing, while general-purpose material has suffered losses in such fields as wall tile and housewares.

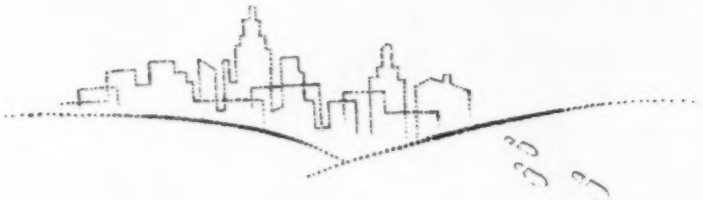
Foster Grant's new high-impact polystyrene. The company asserts that its new styrene graft polymer has improved characteristics such as high flex resistance, resiliency, and semi-transparency. It is claimed to show no yellowing of delicate tints. This is F-G's first high-impact, styrene-type material and is suggested for such standard applications as refrigerator inner doors, housings, radio cabinets; it may also find a use in those food packages where visibility is desirable. The material is produced in F-G's new multi-million dollar plant at Leominster, Mass.

How much epoxy? Figures on the volume of epoxy resin sold in 1957 have not yet been released by the Tariff Commission, but guesses in the industry are that the total was about 28 million lb., compared with 23 million in 1956. Of this amount, about 8½ million is the 80¢-per-lb. liquid resin used for tooling—even though that use fell off somewhat in 1957—and for laminating, encapsulation, and a host of small miscellaneous uses, including less than 1 million lb. for adhesives. The remainder of the total went into coatings. Although sales declined in November and December, they seem to have picked up in January and February. A growth of 15 or 20% is expected in 1958 and for several years thereafter, although a pick-up in some of the undefined "miscellaneous" uses may result in faster progress.

Among the miscellaneous possibilities is a new idea for using epoxy with steel fibers, reported on p. 196 of this issue. The adhesive property of epoxy is such that there should be no worry over "wetting" the metal fiber, and there is no danger of rust since the metal is completely sealed in by the resin and is then coated with a gel material. The metal fibers are made uniform by a new broaching process patented by Bakelite.

Ethyl cellulose sheet in wide width brings economies. Dow Chemical is now casting Ethocel sheet in 40-in. widths. The previous maximum width was only 30 in., with a consequent limitation of market. The new width is especially intended for processors who desire several widths from one roll. In the 40-in. width a 5-mil-thick roll at $.206/1000 sq. in. is competitive with other thermo-

Don't chase after your moldings!



Sometimes it takes more than one engineering technique to complete a plastics product or part. A finished product, for example, might be made of compression molded sections, injection molded pieces, and potted electrical components. Let's not forget the whole thing has to be assembled, too. As a result, if a fellow splits up an involved job like this among several custom molders, he can get all tied up chasing after parts and checking on the progress of the different elements. He can end up with a pair of mighty sore feet, also.

This is the kind of fuss you can avoid by bringing the entire project to Boonton, where in addition to our regular compression and injection custom molding service, we've also got a Special Products Division set up to do casting . . . potting . . . low pressure molding . . . dipping . . . and electronic assembly. When all the activity takes place under one roof, like that, it costs you a whole lot less—because assembly's quicker and traffic's more efficient. And just as important, *we* take care of traffic . . . not you.

So if you have a plastics project that involves several steps— bring it to Boonton. You can be sure we'll do a good job of tying all the ends together. We wouldn't have it any other way. And neither would you.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

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Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
Philadelphia Area—Pioneer 3-0315

The Plastiscope

(*Continued from page* 41)

plastics used for menu covers, portfolios, greeting cards, and story boards used in making animated movies.

Among the advantages claimed over other cellulosics are white light transmission, lay-flatness, drawability, and dimensional stability. It is manufactured in 3-, 5-, 7½-, 10-, and 15-mil thicknesses in 12½–in. O.D. rolls. Standard sheets 30 and 40 in. wide, ranging from 25 to 40 in. long, are also offered at the regular price.

Expandable polystyrene beads. Dow Chemical has made plastics news from all sorts of directions this past month, as is apparent from other paragraphs in this column. One of the latest is the announcement that the company is now producing expandable polystyrene beads, trademarked Pelaspan. Main feature, says Dow, is their uniform size and wide molding range with good surface, and a short heating-cooling cycle during molding. Expandable polystyrene beads can be foamed in place to take the shape of their container. They are used primarily as insulation—one application is in the door of Montgomery-Ward's new refrigerator. The new beads are also used for packaging, flotation, floral decoration, novelties, and toys.

Another news item from Dow is word that its unmodified, oriented polystyrene film, which is said to have excellent indoor aging and dimensional stability, has been on allocation since January. One place it has caught on is in window envelopes where it is said to be 20 to 40% cheaper than some competitive materials—it is also used for window cartons, laminations, overwraps, and a few bags. Approximate yield of a 1-mil film is 25,400 sq. in./lb. Price per 1000 sq. in. of a 1-mil film, 2½ through 40 in. wide, is $.0236. For Dow news concerning Tyril in dinnerware see p. 238.

Low-cost plasticizer maintains plastisol viscosity during storage. After more than a year of extensive application by its customers, Socony Mobil Oil Co., Inc. reports that acceptance of Mobilsol L for use in plastisols has been unusually successful for this type of material. Mobilsol L is a petroleum hydrocarbon plasticizer that is used to replace 15 to 25% of the DOP in a plastisol formulation. It is also suggested for use with DIOP, DIDA, and resinous plasticizers. Its chief advantage is cost—68¢/gal. or about 9¢/lb.; but it has other valuable qualities. The control of flow properties of a plastisol is largely a function of plasticizers, and Mobilsol L is particularly valuable in helping to create a low viscosity; according to Socony, it may even replace higher-cost adipate esters for that purpose. When used to replace 15 or 25% of the DOP in a formulation, it gives a viscosity reduction of 20 to 40 percent. Perhaps even more important, it will help to produce a plastisol of a uniform viscosity throughout the application cycle and inhibits viscosity increases during storage.

In addition to the above properties, it is asserted that Mobilsol L, when used at from 15 to 25% replacement of a primary plasticizer, will give improved low-temperature flexibility, good light stability, internal lubrication, pigment wetting, and good tensile properties.

For additional and more detailed news see Section 2, starting on p. 230.

Are you Blow-moulding yet?

A TYPICAL LAYOUT

OUTSTANDING FEATURES

- ★ Fully automatic equipment.
- ★ High speed production.
- ★ Versatile — up to twelve different items can be produced at the same time.
- ★ Models available for all types of polythene, nylon, etc.
- ★ Will handle sizes from 5 to 1750 cc. capacity.
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Early delivery of complete plants or individual machines for automatic Blow-moulding in all types of plastic materials. Complete Technical Advisory, Product Design, and Mould Supply Service.

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U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

Packaging Notes

Sealed Polyethylene Box Liners for apples have been found to eliminate weight loss, retard ripening and reduce scald of apples held in cold storage. Sealed liners were found to be superior to coated paperboard liners and unsealed liners for most varieties of apples tested. Research showed, however, that quality and uniformity of the film used played an important part in its effectiveness in lengthening apple storage life.

Poly Film to be Featured at National Packaging Exposition in New York, May 26-30. U.S.I. will introduce at the show a new polyethylene film of unprecedented clarity. The broad range of PETROTHENE polyethylene resins expressly developed by U.S.I. for packaging applications will also be demonstrated.

The show, sponsored by the American Management Association, is expected to attract more than 40,000 visitors. Exhibits will feature the latest in packaging machinery, materials and design. Technical sessions will also be held.

Theme of the U.S.I. exhibit at the show will be "PETROTHENE Polyethylene for clear, tough, protective film." U.S.I. Technical Service engineers will be on hand to answer questions on film processing and applications. Packagers and others interested in using polyethylene film can see extraordinary film clarity and toughness demonstrated at the U.S.I. exhibit. (Booth nos. 221, 225, 322 and 326 on the fourth floor of the N. Y. Coliseum.)

New York Coliseum, site of the 27th Annual National Exposition at which U.S.I. will introduce film made from its new high clarity polyethylene.

New Heat Seal Booklet discusses the factors involved in obtaining satisfactory heat seals on polyethylene film. The 16 page booklet is illustrated with 40 graphs showing how time, temperature, melt index, slip agents and resin density affect heat sealing. Heat seal characteristics are given for various resins in U.S.I.'s PETROTHENE polyethylene resin series. Copies of the booklet are available without charge to extruders, convertors and packagers. Write to U.S.I. for "Heat Seal Characteristics of Polyethylene Film."

New U.S.I. Plant Will Produce 75,000,000 lbs. of Polyethylene a Year

Houston Facility Scheduled for Completion Next Winter

A second plant to produce U.S.I. PETROTHENE® polyethylene is scheduled to go on stream next winter in Houston. Capacity of the plant—75,000,000 pounds per year of intermediate density polyethylene resins—will almost double U.S.I.'s present polyethylene capacity. The plant at Tuscola, Ill., now has a 100,000,000 pound-per-year capacity.

Site for the new plant was selected to meet two prime considerations—easily accessible transportation for fast customer service, and a dependable supply of quality raw materials.

The 200 acre site on the Houston Ship Canal provides both. Shipments will be made by rail and truck, with the port facilities of Houston available for export orders. High purity ethylene will be piped in from nearby existing facilities of The Phillips Petroleum Company. Phillips will also supply the natural gas requirements of the plant.

The new installation will use a modification of the conventional high-pressure process, already proved in the Tuscola plant. Intermediate density resins will be produced, with properties somewhere between those of the original polyethylene resins and the new high-density resins produced by low-pressure processes.

PETROTHENE polyethylene plant at Tuscola, Ill.

National Petro-Chemicals is presently the third largest polyethylene producer in the United States. Petro has quadrupled PETROTHENE capacity in the past three years.

U.S.I. Assumes Full Control of National Petro-Chemicals

Full stock ownership of National Petro-Chemicals Corporation, producer of PETROTHENE polyethylene resins, has been acquired by U.S.I.'s parent company, National Distillers and Chemical Corp., from Panhandle Eastern Pipeline Company.

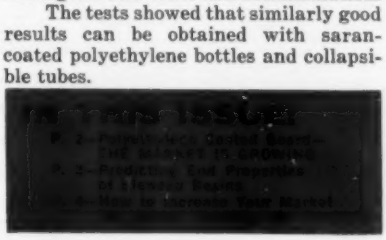
National Petro-Chemicals has been majority owned and managed by U.S.I. since its founding.

Saran-Coated Polyethylene Film Offers Improved Clarity, Lower Permeability

A recent evaluation of saran-coated polyethylene film indicates that as little as 0.1 mil of saran coated or laminated to polyethylene film gives improved clarity to the film and greatly increases its impermeability to oils, organic liquids and gases.

This latter property, especially, promises to open up new packaging applications to coated polyethylene film. It permits the packaging of such foods as processed meats and cheeses in either a vacuum or inert gases, and helps retard oxygen-caused rancidity and discoloration in packages containing fats, oils, dried whole milk and many other products. Reduced permeability to organic liquids and vapors would enable the film to increase the shelf life of pharmaceutical products and furnish better protection against off-taste and contamination.

The tests showed that similarly good results can be obtained with saran-coated polyethylene bottles and collapsible tubes.



Polyethylene Coated Board—

the market is growing

DETAILS ON BACK

Polyethylene extrusion-coated board is replacing conventional coated board in more and more applications. In packaging food and dairy products, furniture, chemicals, industrial parts, users are finding that only polyethylene offers all these advantages: EXCELLENT WATER VAPOR RESISTANCE • SUPERIOR GREASE RESISTANCE • HEAT SEALABILITY • GOOD ADHESION OF COATING • TOUGHNESS AND SCUFF RESISTANCE • WILL NOT SCRATCH OTHER SURFACES • PRINTABILITY • NO TASTE, NO ODOR, NO CONTAMINATION OF FOOD FROM COATING SUBSTANCE

In Polyethylene Coating, PETROTHENE® Resins Give You Top Results—

HERE'S WHY: PETROTHENE polyethylene resins are made at U.S.I.'s modern, integrated facilities at Tuscola, Ill., and have several important advantages over many other polyethylenes. PETROTHENE resins have good draw-down properties which enable you to coat at appreciably faster production rates. They give you good adhesion, with minimum hot melt oxidation. And PETROTHENE coatings have no taste or odor—an important consideration in many packaging operations. For all polyethylene extrusion coating applications, take advantage of the properties of PETROTHENE polyethylene. It costs no more.

U.S.I. IS HELPING YOU EXPAND YOUR COATED BOARD MARKET WITH INDUSTRY-WIDE ADS LIKE THIS—

To develop new markets and increase polyethylene coated board sales in present markets, U.S.I. is sponsoring a series of ads such as the one at left. These ads tell your customers about the market advantages of polyethylene-coated board. The series will run regularly in leading trade publications. For reprint copies of these ads as they appear, write:

USI INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

U.S.I.
Vol. III No. 2

POLYETHYLENE PROCESSING TIPS

PREDICTING END PROPERTIES OF BLENDED RESINS

A polyethylene processor may attempt blending of resins either for economic reasons or to attain a specific set of properties.

He may be successful, but blending, in general, is not considered good practice because it is difficult to obtain a homogeneous blend and the end results are difficult to predict – especially if the resins are from different manufacturers.

However, if you find it necessary to blend, it is possible to predict certain end properties with reasonable accuracy.

Melt index and density are predictable

Assuming that your polyethylenes are closely enough related, it is possible to blend for specific melt indexes and densities and therefore to obtain the desired properties that are functions of either of these.

The chart and the formula given here will enable you to predict either melt index or density. If you are blending for melt index, the logarithmic average will give the correct figure. Simply follow the directions in the caption under Figure 1. If you are blending for density, the arithmetic average will be correct. Simply use the formula described in the example given with Figure 2.

Recommended Precautions

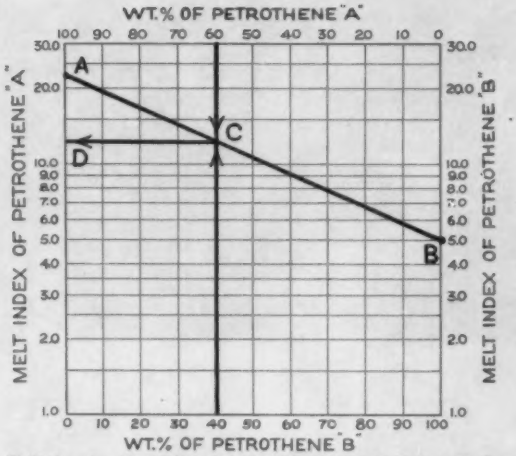
It is recommended that you limit yourself to injection molding when working with resin blends. If you are using a rotary drum for mixing, allow a tumble time of at least 20 minutes.

Shots should be relatively large, limited generally to about eight ounces in single cavity molds and twelve ounces in multiple cavity molds. Restrictive gatings, back pressure plates or similar devices, however, promote homogeneous mixing and sometimes smaller items can be effectively molded when these devices are used.

U.S.I. offers technical assistance

An answer to your individual need may well be found in obtaining directly from a manufacturer a polyethylene resin with the properties you want. And remember that U.S.I.'s Technical Service Engineers are always ready to work with you in finding the solutions to specific resin property problems.

FIGURE 1:



To Determine the Melt Index of a Blend of Polyethylene Resins having Different Melt Indexes –

1. Assume you are blending 90 pounds (60%) of U.S.I. PETROTHENE® 202 polyethylene resin with 60 pounds (40%) of PETROTHENE 201.
2. Petrothene 202 has a melt index of 22.0. On the left hand scale, therefore, fix a point at 22 (indicated by "A").
3. Petrothene 201 has a melt index of 5.0. On the right hand scale fix a point at 5 (indicated by "B").
4. Draw a line connecting 22 and 5.
5. Since you are using 40 percent of resin B(201), fix a point at 40 on the bottom and draw a vertical line.
6. From the point where these two lines intersect ("C"), draw a horizontal line so that it intersects the left hand scale ("D").
7. At "D" you now can read the melt index of your proposed blend.

This technique can be used to calculate the melt index of two polyethylene resins from the same manufacturer. If you do this type of blending frequently, you can set up these scales on any semilogarithmic graph paper. Your U.S.I. Technical Service Engineer will show you how.

FIGURE 2:

(% A) × Density of A + (% B) × Density of B = Density of blend

To Determine the Density of a Blend of Polyethylene Resins Having Different Densities –

1. Consider that you are mixing 105 pounds (70%) of U.S.I. PETROTHENE 206 (density 0.924) with 45 pounds (30%) of PETROTHENE 201 (density 0.916). Call resin 206 "A", and resin "201" "B".
2. Substituting these quantities and densities for the symbols in the formula above, you get the following numerical equation –

$0.70 \times 0.924 + 0.30 \times 0.916 = 0.9216$

3. The density of your blend therefore is 0.9216.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

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Division of National Distillers and Chemical Corporation
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Branches in principal cities

16 point board with a 14.4 lb. (1 mil) coating of PETROTHENE® 205 polyethylene resin. PETROTHENE coatings can be drawn down as low as 1/10 mil thickness.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.

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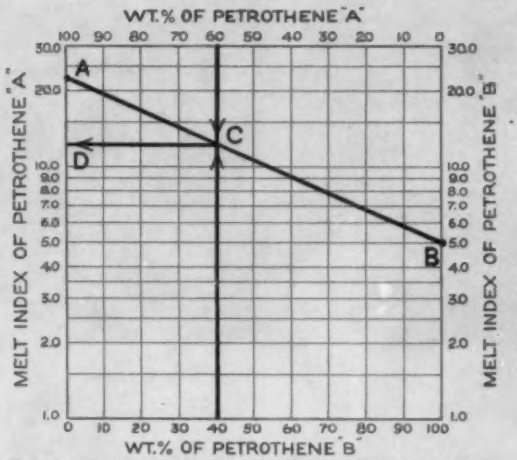

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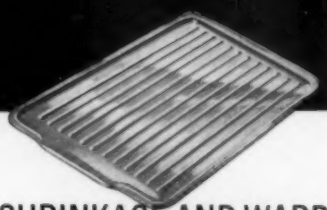
99 Park Ave., New York 16, N.Y.
Branches in principal cities

HOW TO INCREASE YOUR MARKET FOR MOLDED POLYETHYLENE PRODUCTS...

We all know what a good plastic material we've got in polyethylene. It's durable, attractive and economical. But remember—the sales appeal of molded polyethylene products is based on SERVICEABILITY. In the long run, the size and growth of your molded polyethylene market depend on how well you build quality into your products. It's not an easy job. Here are a few typical problems that molders encounter frequently, and some of the suggestions that U.S.I. technical service people have come up with:



LOW TEMPERATURE FLEXIBILITY

Understandably, there's little market future for polyethylene garbage cans that shatter on a cold winter's morning. The secret of getting good low temperature flexibility lies in proper resin choice. Look for resins with low density. As far as melt index is concerned, the lower the better for low temperature flexibility—providing the resin can be molded without going to pressures that will cause locked-in stresses. Avoid unrelieved stresses caused by poor design or molding techniques. And use-test your finished product—theoretical resin brittleness values may not mean much under practical conditions.

Recommended PETROTHENE® resins: 202, 203, 206, 207.

STRESS CRACK RESISTANCE

Why will a polyethylene carboy safely carry sulfuric or hydrofluoric acid, while a housewife's dishpan may split from the chemical effects of ordinary household detergent? The answer again involves stress and choice of resin. Specifically, resins of higher molecular weight or lower melt index, and polyethylenes of narrow molecular weight distribution, such as Petrothene resins, have less tendency to crack under environmental stress. Residual strains left after molding will also have a marked effect on stress crack resistance.

Recommended PETROTHENE® resins: (for housewares): 200, 203, 205, 207.

SHRINKAGE AND WARP RESISTANCE

Molded products are moving into new markets where dimensional accuracy and stability are essential. Warpage in flat items, such as drainboards and large covers, is chiefly affected by molding conditions. However, resins of lower density and lower average molecular weight will have slightly less tendency to warp. Shrinkage, too, is a result of molding conditions, especially temperatures, but here again resins of lower density are less subject to shrinkage.

Recommended PETROTHENE® resins: 201, 202, 203.

For advice on specific molding problems and resin selection, contact U.S.I. Technical Service.

HERE'S HOW U.S.I. HELPS YOU TELL YOUR CUSTOMERS ABOUT THE MARKET ADVANTAGES OF QUALITY IN POLYETHYLENE PRODUCTS

In a series of ads like the one at left and in an illustrated booklet, "The Goose that Laid the Golden Egg," U.S.I. is presenting to buyers of housewares and other molded polyethylene products the reasons why quality is their best market booster. The ads and booklet emphasize the importance of well designed, well molded, serviceable products in maintaining consumer confidence in polyethylene. The program is designed to help tell your customers the advantages of dealing with you, the quality molder. Reprints of these ads and copies of the booklet for you to send to your customers may be obtained by writing to U.S.I.

U.S.I. INDUSTRIAL CHEMICALS CO.

Division of National Distillers and Chemical Corporation

99 Park Avenue, New York 16, N. Y.

Branches in principal cities

Garan Roving helps Amercoat* meet Rigid Specifications for Glass-Plastic Railing

Garan Roving-reinforced plastic railing at Del Mar Turf Club (California) withstands routine "bumping" from tractors—or horses—without buckling or damage.

Improved weathering characteristics and higher physical properties make this glass-reinforced plastic tubing ideal for many architectural uses—both exterior and interior.

Gate, California

found that Garan Roving met their exacting requirements in making tubing in diameters from 2" to 12"; with more strength than steel on a weight basis; unusually high flexural strength; lighter than aluminum; better weatherability.

Here's why Garan Roving did the job:

1. Faster resin wet-out...better bond... speeds production.
2. Improves flexural, compressive and tensile strengths.
3. High wet strength retention...adds durability.
4. Packaged for rapid, trouble-free pull out...cuts fabrication time.

Garan Roving, made by L·O·F Glass Fibers Company, is the quality reinforcement for preforming, corrugated sheet, rod stock, and woven roving applications.

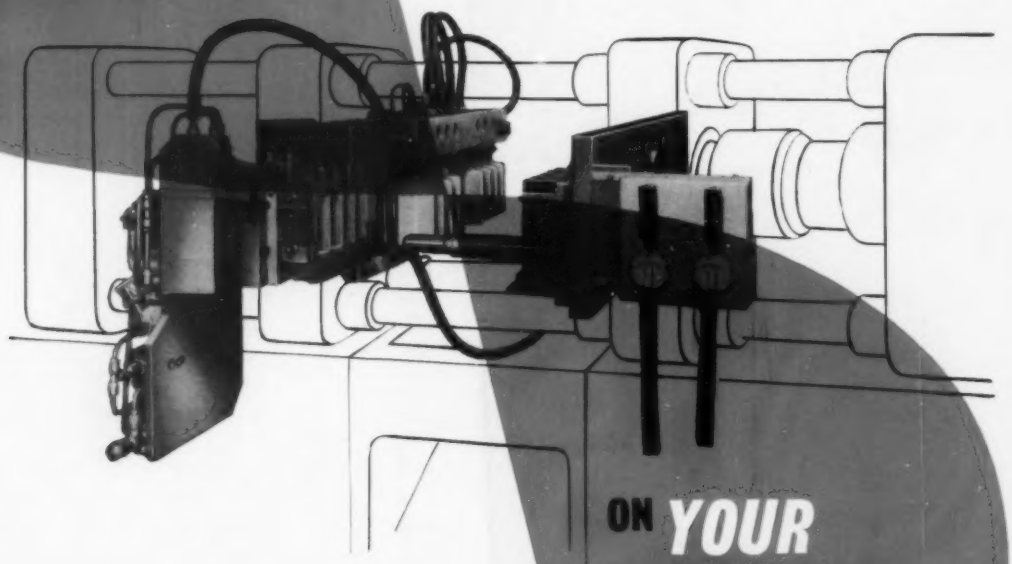
This "horses' eye" view shows the smooth, sturdy, non-splintering inner rail at Del Mar Turf Club. Has high resistance to weathering—won't corrode—doesn't need painting.

For technical information about Garan Roving and how it can improve your product, call our nearest sales office, or write: *L·O·F Glass Fibers Company, Dept. 15-48, 1810 Madison Avenue, Toledo 1, Ohio*

L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY TOLEDO 1, OHIO

AUTOMATIC BLOW MOULDING



ON *YOUR* STANDARD INJECTION MOULDING MACHINE

It is now possible to purchase automatic special blow moulding plant! Simply adapt your standard injection moulding machine with the new, amazingly efficient Granbull Blow Moulding Unit . . . and open up fresh sources of profitable production. Designed for multi-impression work with 'push-button' speed and precision, to the maximum capacity of your machine. Write for full technical details.

OUR MANUALLY OPERATED EQUIPMENT ALREADY USED BY MANY MOULDING COMPANIES IS SUITABLE FOR FITTING TO STANDARD MOULDING MACHINES

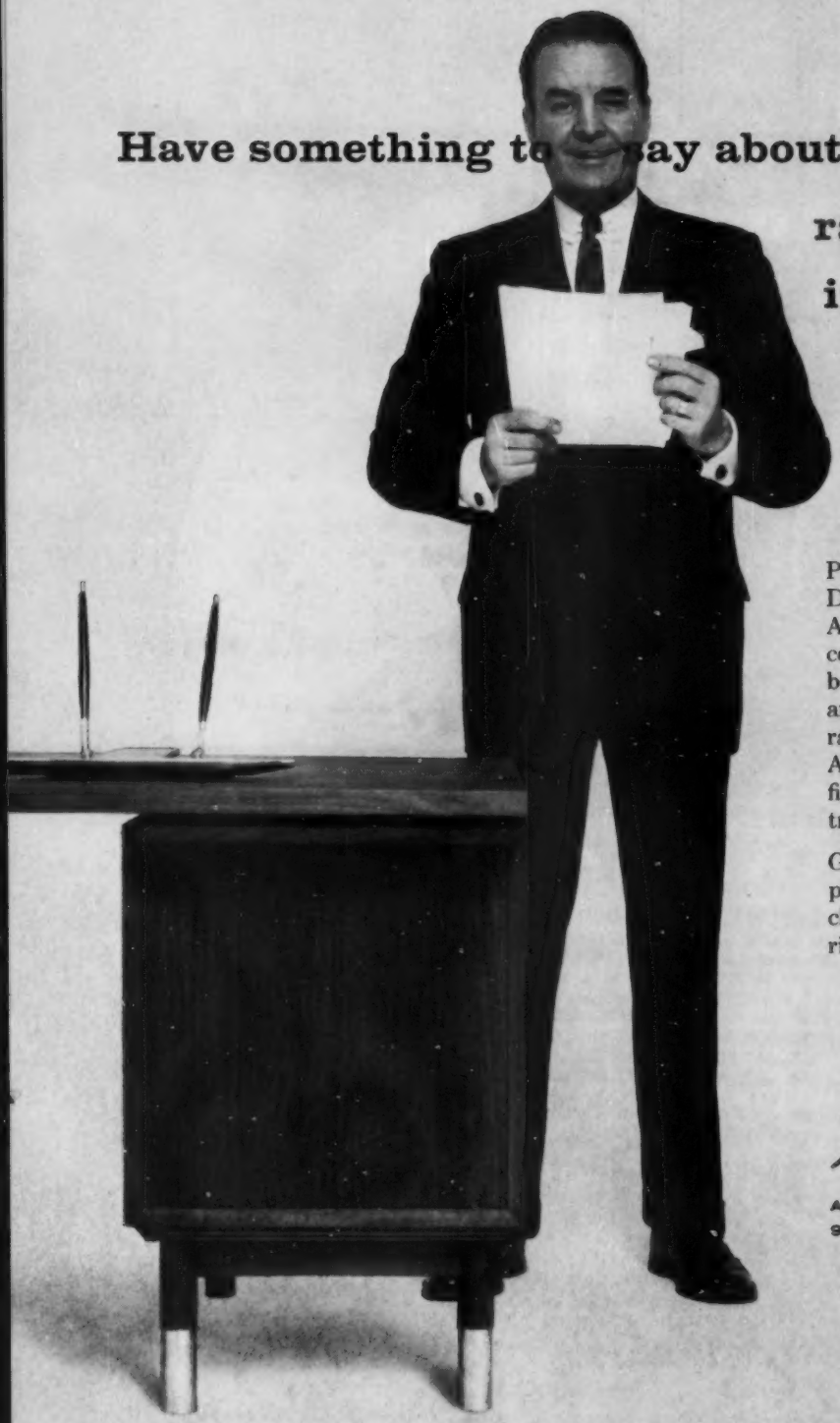
Agents in principal countries

THE GRANBULL TOOL CO. LTD

Registered Office and Works

39 HIGH STREET • KINGSTON-ON-THAMES • SURREY • ENGLAND

AMOCO CHEMICALS—A NEW RESOURCE



Have something to say about the raw materials used in your plasticizers

Phthalate-type plasticizers—DIOA, DDP, DDA, DIOP—made from Amoco Oxo Alcohols are lighter in color and more stable. This is possible because with these Alcohols, esterifiers are starting with the highest quality raw materials. How come? Because Amoco Oxo Alcohols must meet specifications that are setting a new industry level for minimum ester color.

Getting better finished vinyls and improving processing can result from checking the quality of the raw materials used in plasticizers that you buy.

AMOCO CHEMICALS

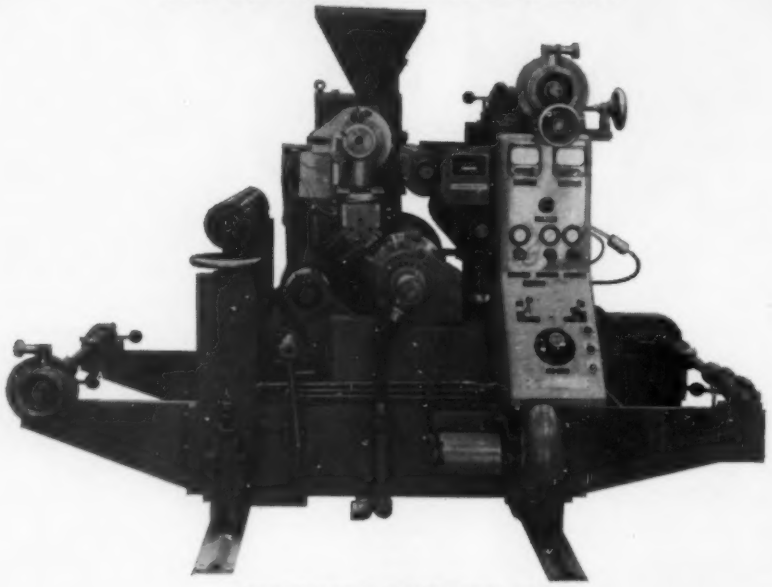
AMOCO CHEMICALS CORPORATION
910 South Michigan Ave., Chicago 80, Illinois

APPROVED BY THE GREATEST NAMES IN THE INDUSTRY

MILPRINT • REYNOLDS METALS • SEALRIGHT • WEST VA. PULP & PAPER • CARBIDE CHEMICALS • NATIONAL ANILINE • HERCULES • KOPPERS • MONSANTO • NATIONAL-PETRO CHEMICALS • PHILLIPS • EASTMAN CHEMICAL • DOW CHEMICAL COMPANY • SHELLMAR-BETNER • DIXIE CUP • INTERNATIONAL PAPER •

Egan

POLYETHYLENE EXTRUDER-LAMINATORS FOR LABORATORY OR PILOT PLANT.



COMPLETELY PACKAGED UNIT

NEOPRENE PRESSURE ROLL WITH WATER BATH
PATENTED LAMINATING NIP ADJUSTMENT
2½" ELECTRICALLY HEATED EXTRUDER
SILICONE ROLL (OPTIONAL)
MASTER CONTROL PANEL
MANIFOLD TYPE FILM DIE WITH ALUMINUM BLOCK HEATERS
SPECIAL COOLING ROLL WITH RECIRCULATING PUMP
24" WEB WIDTH—UNIT SHOWN
BRACKETED REROLL WITH TENSION CONTROL
BRACKETED UNROLL WITH FRICTION BRAKE
SLITTERS & TRIM DISPOSAL SYSTEM
SANDWICH UNROLL POSITION
VARIABLE SPEED DRIVE

WRITE, OR PHONE RANDOLPH 2-0200
FOR COMPLETE INFORMATION
NO OBLIGATON

Egan

FRANK W. EGAN & COMPANY

SOMERVILLE, NEW JERSEY

CABLE ADDRESS: EGANCO—SOMERVILLE (NJER)

Manufacturers of machinery for the paper converting and plastics industries

PAPER-coaters, laminators, treaters, gummers, saturators, embossers, unrolls, rerolls, drying systems, other components; PLASTICS-extruders, dies, take-offs, other accessories.

REPRESENTATIVES: MEXICO, D.F.-M.H.GOTTFRIED, AVENIDA 16 DE SEPTIEMBRE; JAPAN-CHUGAI BOYEKI CO., TOKYO.
LICENSEES: GREAT BRITAIN-BONE BROS. LTD., WEMBLEY, MIDDLESEX; FRANCE-ACHARD-PICARD, REMY & CIE, 36 RUE D' ENGHIEN X, PARIS; ITALY-EMANUEL & ING. LEO CAMPAGNANO, VIA BORROMEI 1 B/7, MILANO; GERMANY-ER-WE-PA, ERKRATH BEI, DUSSELDORF.

Three times thinner than a human hair, this special film, made from Spencer "Poly-Eth" for garment bags, stays uniform and glossy. It's easy to process, clear and printable. Write any Spencer Sales Office for free samples.

It's easy to open and fill garment bags made from "Poly-Eth" because the film doesn't block.

In Film Extrusion For Garment Bags . . .

"Poly-Eth" 2476 and 2477 for Draw-Down

Read how special resins, custom-designed for garment bags, draw-down to 0.5-mil or less; give fast production rates:

We're increasing production of Spencer "Poly-Eth" resins 2476 and 2477. We've had to, to keep from slowing down your profit opportunities. Here's why:

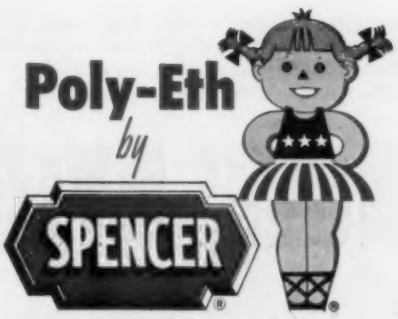
A novelty only two years ago, polyethylene garment bags have won overwhelming customer favor wherever they have been introduced. Establishments without polyethylene bags are now noticeably losing trade to those which package in bags. A sudden new clamor for polyethylene has been the result.

But the film requirements for these bags have grown stricter, too. So to help you get the inside edge on this booming trade, Spencer has specially designed two "garment bag resins," "Poly-Eth" 2476 and 2477. And the resulting demand has far exceeded our expectations.

Excellent processability is one of the outstanding features of these new resins. And the remarkably thin film produced for them breaks records in low cost, transparency and gloss.

It's extra easy to open bags made from "Poly-Eth" 2476 and 2477 because the film's higher density (.925) makes it extra stiff. This "garment bag resin" comes in two grades—2476 with a melt index of 4, and 2477 with a melt index of 8—to meet any extruding conditions.

Be sure to ask your Spencer representative about this new resin, exclusively designed for garment bags. Or write for literature. Address: Spencer Chemical Company, Dwight Bldg., Kansas City 5, Mo.



A rugged nylon—Spencer 401—recently won a new assignment as the result of a grueling test devised for "Mastercut" power mower wheel bearings. H. R. Lasater (left), Ray Hodge, and Al Kearney examine wheel after test. Read below the complete details of this unique test:

This Power Mower Went 70 Miles Per Hour!

Torturous test proves advantages of Spencer Nylon bearings over metal. Also, molder reports Spencer Nylon is easier to mold than older-type nylons, and cuts cycle time:

"Use plastic for bearings in our mowers?" H. R. Lasater, service manager of Aircapitol Manufacturers in Wichita, Kansas, was dubious. "Why, it would never stand up in power mower wheels!"

"Spencer Nylon will stand up—better than the average ball bearings!" The reply came from young Ray Hodge, President of Midwest Plastic Company, also in Wichita. "Test it and see!"

Accepting Hodge's challenge, Lasater consulted his chief inspector, Al Kearney. They hooked up one of their "Mastercut" power mowers—equipped with bearings made from Spencer Nylon 401—to the back of a car.

They then towed the mower 102 miles on the Kansas Turnpike, six miles of the journey at 70 miles an hour—a pace that would induce a side wobble with metal ball bearings. After the test, however, the nylon bearings showed no sign of wear. Today the majority of "Mastercut" mowers have nylon bearings made by Midwest Plastic. And nylon bearings cut materials costs 70% over the metal bearings previously used.

Hodge Uses Spencer Nylon 401 exclusively for these bearings. "I find Spencer Nylon is easier to mold," he declares, "far easier than the first nylon we used, where we had to be *so* cautious with the nozzle temperature."

"Also, our cycle time is decreased, which means more shots per hour. And because of Spencer's excellent processability, we get fewer rejects. It takes less pressure, too. It sets up quicker and, unlike the other nylon tried, you don't have to pre-dry Spencer 401."

You too may find that the special properties of Spencer Nylon make it the ideal plastic for your nylon needs. For complete information write: Spencer Nylon, Spencer Chemical Company, 600 Dwight Bldg., Kansas City 5, Mo.

NOW! NYLON *by* SPENCER

SPENCER

SPENCER CHEMICAL COMPANY

GENERAL OFFICES: DWIGHT BUILDING, KANSAS CITY 5, MISSOURI

Q. *What is the basic principle of molding?*

A. The process of melting plastic to form a shape!

Q. *What newest device accomplishes this best?*

A. The new LOMBARD THERMALINER because it plasticizes faster, provides 20% to 25% more pounds per hour, speeds the cycle and is maintenance free!

You'll never know how much an injection molding machine can do until you use a

LOMBARD

LOMBARD GOVERNOR CORPORATION

ASHLAND, MASS.

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Philadelphia, Pa., Turner 4-7833
Stamford, Connecticut, Davis 4-2257
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Plas-D-Vision
Leominster, Mass., Leominster 4-9172

Addy & Luby Machinery Co.
Detroit, Michigan, Trinity 5-8742

Joseph Monahan & Co.
Grand Rapids, Michigan, GL 8-5917

Neff, Kohlbusch & Bissell
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Indianapolis, Indiana, Walnut 3-9243

for plastics and resins

90 plants

20 products

1 builder

Blaw-Knox, pioneer in the industry, sets the pace in designing and building plants for polymer and resinous compound production.

Blaw-Knox has led for twenty-five years in plant development for products ranging from condensation polymers such as alkyds and polyesters to addition polymers including synthetic rubber, polyvinyl chloride and polyvinyl acetate. Blaw-Knox construction parallels the mushrooming growth of the industry.

Blaw-Knox unexcelled know-how will pay off on your next project. A complete service is available—from preliminary planning to initial operation. Contact Blaw-Knox for details.

BLAW-KNOX

BLAW-KNOX COMPANY

Chemical Plants Division • Pittsburgh 22, Pa. • Chicago 1, Ill.

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Fewer Fines · Easier-to-Handle · Economical

NATIONAL®
MALEIC ANHYDRIDE
TABLETS

THE TABLETS WITH THE "CORNERLESS CONTOUR"

You win three ways when you specify "National Maleic Anhydride Tablets":

Pressed to shape in modern tableting machines, they resist degradation. As delivered, they contain 75-90% fewer fines as shown by screen-analyses comparison with other leading brands after a 1,000-mile truck haul!

They are uniform because they are made by a continuous catalytic-oxidation process developed by National Aniline Research.

You get mixed car or truckload rates on combination orders for any of the resin-chemicals listed on shipments from plant or many branch warehouse stocks.

You'll like our quality, service and price. Why not get our quotation on your next order?

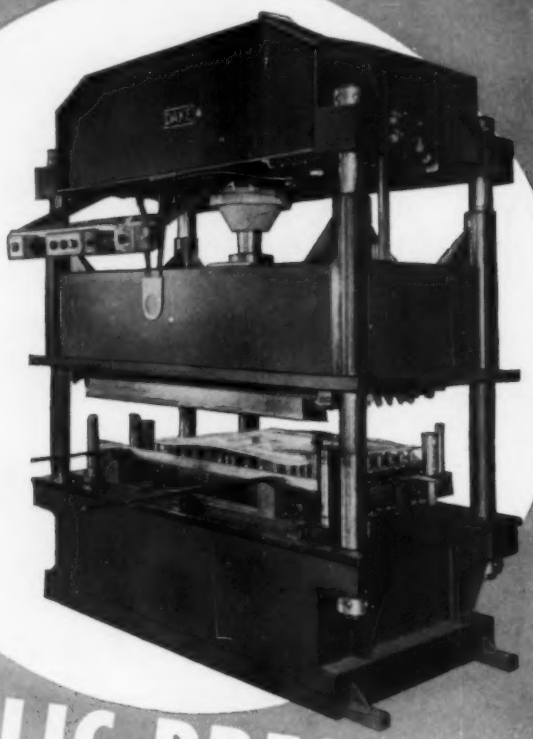
MALEIC ANHYDRIDE
Tablets — Rods — Molten

Phthalic Anhydride
Hexahydrophthalic Anhydride
Tetrahydrophthalic Anhydride
Nadic® Anhydride
Dodecenylsuccinic Anhydride
Fumaric Acid
Succinic Anhydride
Succinic Acid
Malic Acid
Adipic Acid

Allied Chemical

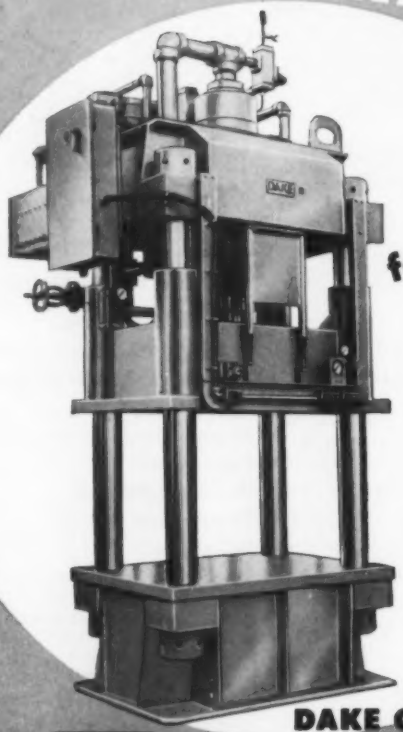
NATIONAL ANILINE DIVISION ALLIED CHEMICAL & DYE CORPORATION
40 Rector St., New York 6, N. Y. • Akron Atlanta Boston Charlotte Chattanooga Chicago
Greensboro Los Angeles New Orleans Philadelphia Portland, Ore. Providence San Francisco Toronto

available in standard and custom engineered models



for trimming and piercing vacuum-formed plastics

DAKE HYDRAULIC PRESSES



for molding reinforced plastics

Be a pacemaker in the fast-moving plastics industry with equipment designed to keep production geared to modern trends. Dake Hydraulic Presses speed output and reduce costs. They are job-engineered by men experienced in the plastics industry. These men are ready to help you meet special requirements as well as provide better equipment . . . both for compression molding of reinforced plastics as well as trimming and piercing vacuum-formed plastics. Standard models are electric-hydraulic in operation, with capacities ranging from 25 to 300 tons. They are adjustable for stroke, pressure, temperature and timing. Dual palm-operated controls are standard, providing safety in operation. Dake will gladly work with you in developing whatever special press equipment you need.

For descriptive literature on these presses, write for Bulletins 340 and 352.

DAKE CORPORATION 648 Robbins Road, Grand Haven, Michigan

DAKE PRESSES

Arbor Presses

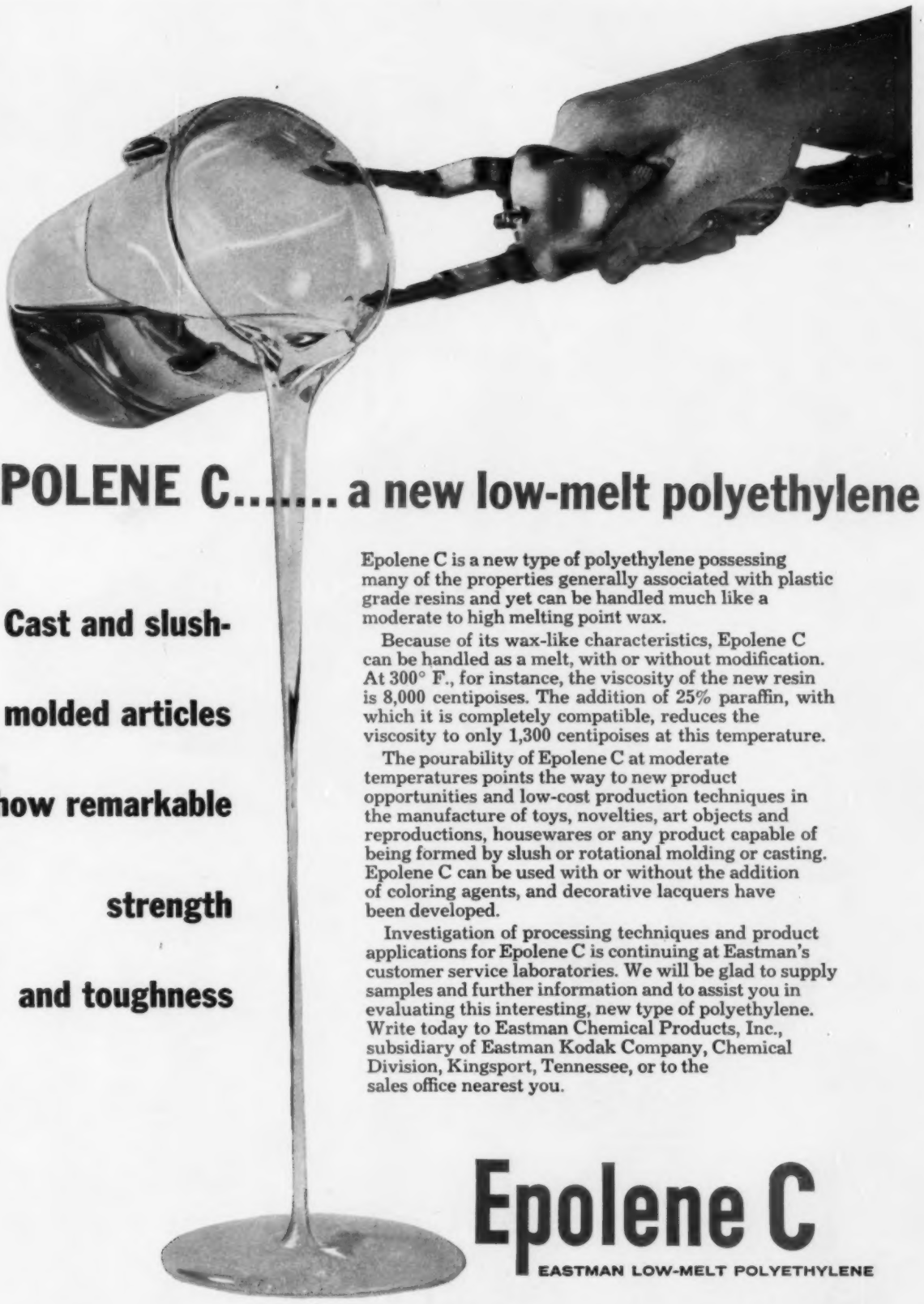
Hand-Operated Hydraulic

Power-Operated Hydraulic

Guided Platen

Gap Type Presses

Movable Frame



EPOLENE C..... a new low-melt polyethylene

Cast and slush-molded articles show remarkable strength and toughness

Epolene C is a new type of polyethylene possessing many of the properties generally associated with plastic grade resins and yet can be handled much like a moderate to high melting point wax.

Because of its wax-like characteristics, Epolene C can be handled as a melt, with or without modification. At 300° F., for instance, the viscosity of the new resin is 8,000 centipoises. The addition of 25% paraffin, with which it is completely compatible, reduces the viscosity to only 1,300 centipoises at this temperature.

The pourability of Epolene C at moderate temperatures points the way to new product opportunities and low-cost production techniques in the manufacture of toys, novelties, art objects and reproductions, housewares or any product capable of being formed by slush or rotational molding or casting. Epolene C can be used with or without the addition of coloring agents, and decorative lacquers have been developed.

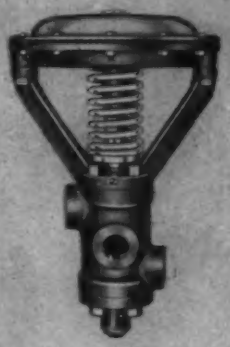
Investigation of processing techniques and product applications for Epolene C is continuing at Eastman's customer service laboratories. We will be glad to supply samples and further information and to assist you in evaluating this interesting, new type of polyethylene. Write today to Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, Chemical Division, Kingsport, Tennessee, or to the sales office nearest you.

Epolene C

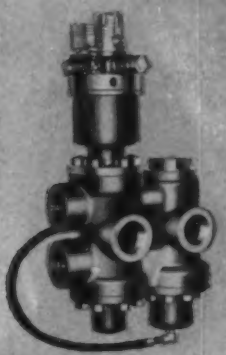
EASTMAN LOW-MELT POLYETHYLENE

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tennessee; New York City; Framingham, Massachusetts; Cincinnati; Cleveland; Chicago; St. Louis; Houston. **West Coast: Wilson Meyer Co.,** San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

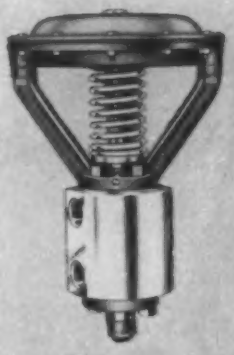
for push button automatic control . . . faster action . . . trouble-free service . . .



4000 PSI BALANCED 3 WAY VALVE



3000 PSI 4 WAY HYDRAULIC VALVE



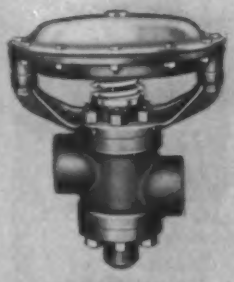
6000 PSI BALANCED 3 WAY VALVE

SPECIFY

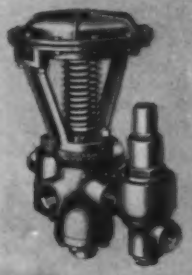
SINCLAIR-COLLINS

DIAPHRAGM-OPERATED CONTROL VALVES

2, 3 and 4-way • single or two pressure • high or low pressure — air operated, oil operated • for oil, air, steam, hot or cold water service • remote manual or automated control



4000 PSI 2 WAY VALVE —DIRECT ACTING —NORMALLY OPEN TYPE



4000 PSI 2 PRESSURE, HYDRAULIC OPERATING VALVE—AUTOMATIC HIGH PRESSURE

Any rubber or plastic processing equipment you manufacture or operate will perform better—at lower cost—with Sinclair-Collins valves!

Shockless inlet and release pressures, Stellite valve stem seats, replaceable hardened stainless steel seat sleeves, cast navy bronze (4000 psi) or hi-tensile bronze alloy billet (6000 psi) valve bodies which resist the corrosive action of water and high velocity hydraulic fluids . . . all these features add up to peak, trouble-free performance and lower maintenance costs!

Consider your high pressure valve requirements carefully. Then call in your nearby Sinclair-Collins representative. You'll find that he can supply your valve needs *exactly* . . . in sizes from ½ to 3 in. . . . all available for fast delivery from stock. Write for brochure. The Sinclair-Collins Valve Company, 454 Morgan Avenue, Akron 11, O.

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THE SINCLAIR-COLLINS VALVE COMPANY

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You'll be tickled pink —the right shade, too— when you give us your toughest color problems!

The new FOSTARENE color-blending plant is the last word in facilities, capacity, personnel — and *flexibility*. Now you can get quick, accurate service *even on small orders*. Up-to-the-minute color blending processes permit production of a full range of colors *without* contamination. Colors are continuously checked on the most modern equipment, including D. U. and Rapid Scanning Spectrophotometers, Lumetron Colorimeter and Macbeth Artificial Light. Give us your toughest, most elusive color-matching problems. We take them in stride!

FOSTARENE is the polystyrene with this difference: proof of performance plus personalized service. And what a difference it makes in cutting costly rejects! Investigate FOSTARENE for your molding operations.

FOSTARENE®
STYRENE PLASTICS

FG

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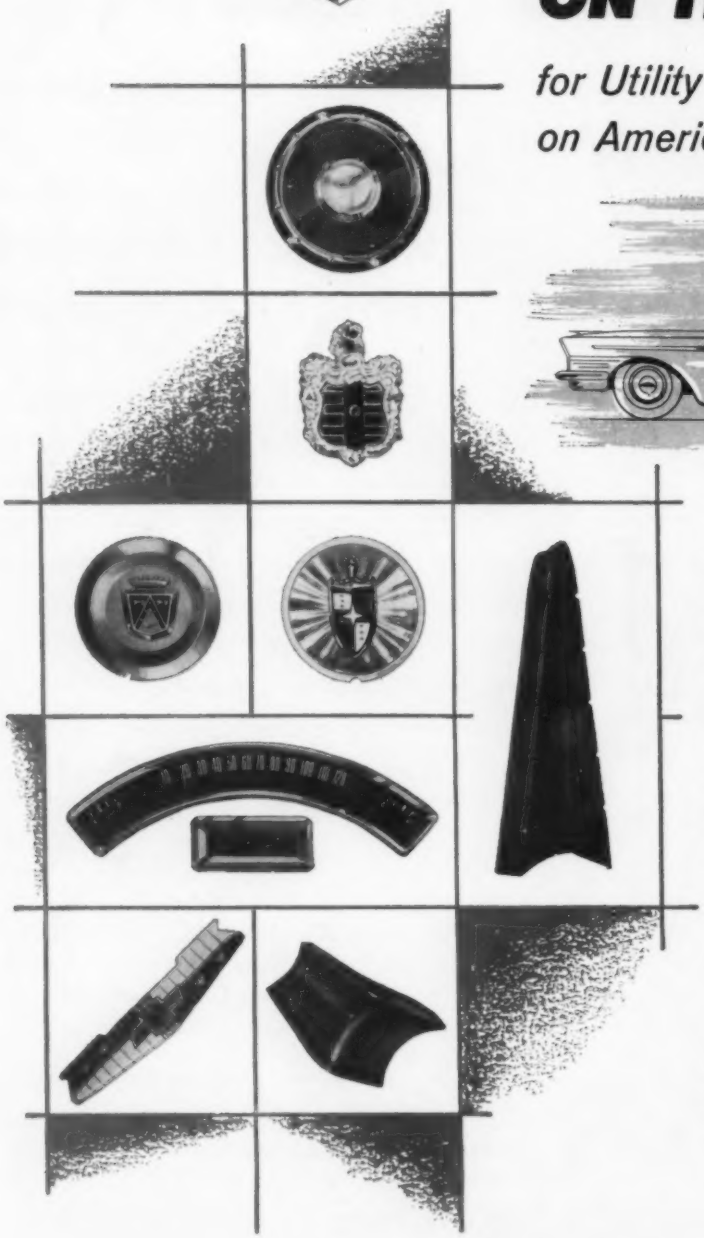
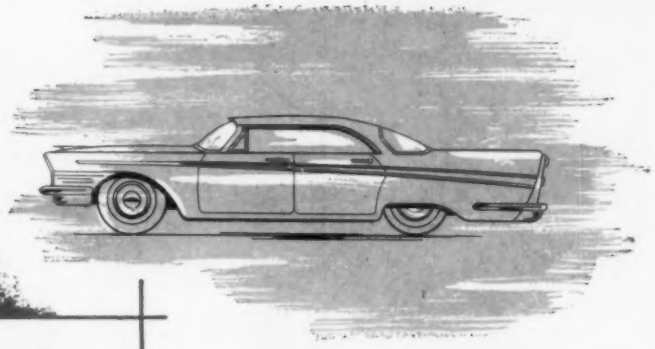
PLASTICS ON THE ROAD . . .

for Utility and a Touch of Beauty on America's Most Popular Cars





ERIEFLEX Reflector Lenses are an important factor of safety on the nation's highways. They combine the superior brilliance of acrylic with special prismatic design that reflects light over a greater distance and width of range. They deliver higher candle power, are practically unbreakable in shipping, handling, and assembly, have dimensional accuracy for quick, easy assembly, and exceed S.A.E. and state automotive requirements.

ERIE Three Dimensional Plastics in horn buttons, nameplates and ornaments are the last word in beauty . . . and the wide arc speedometer dial is given an added appeal by ERIE External Metallizing; an economical finish for plastic, equal in richness and lasting luster to electroplating on metal and with almost unlimited possibilities for application to other articles.

Write for a copy of the new ERIE Plastics Facilities Bulletin.

ERIE *Plastics Division*

ERIE RESISTOR CORPORATION

MAIN OFFICES: ERIE, PA. FACTORIES: ERIE, PA. • HOLLY SPRINGS, MISS.

Save time, money, storage space with—

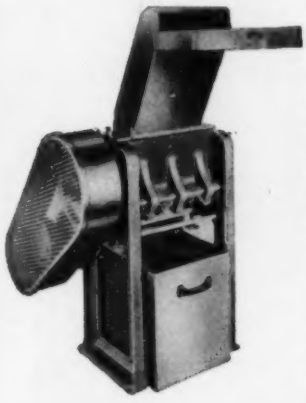
DE MATTIA GRANULATORS

PROCESS ALL YOUR SCRAP

right in your own plant. With De Mattia Scrap Grinders in your molding shop you can process all your scrap — large chunks from heating cylinders, accumulations from sprues and reel tough molded pieces — in your own plant, at once. Space for press-side installation saves handling and make salvaged material immediately available. There is a De Mattia model for every scrap processing need.

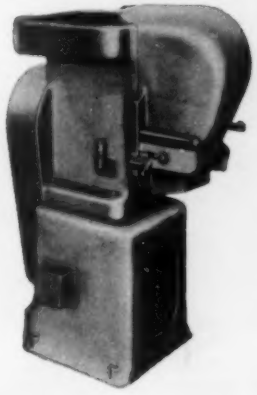
WRITE FOR NEW BULLETINS GIVING ON DE MATTIA GRANULATORS AND HIGH EFFICIENCY [illegible] conditions as it [illegible] Mattia molding equipment.

GRANULATOR No. 1



Simple, rugged and highly efficient. Has capacity of 200 lbs. per hour. 3 H.P. Motor with double V belt and Meehanite flywheel. Features high grade roller bearings with positive seal. Four cutting blades placed on a bias permit efficient cutting of thin strips in Vinyl, Saran, etc. Standard screen with ¼" openings (other screen sizes on request). Hopper opening 13¼" x 4½". Floor space required 32" x 44"; net weight with motor (approx.) 800 lbs.

GRANULATOR No. 3



For low-cost salvage of the large slugs and chunks resulting from cleaning out the heating cylinder, accumulation at the nozzle and also those molded pieces too tough for the average sprue and scrap grinder. Capacity — Over 150 lbs. per hr. 3 H.P. Motor in Base. Double V Belt Drive. Heat treated Alloy Steel Rotor High Grade Roller Bearings with Positive Seals. Standard Screens with 11/32" Openings (other sizes on order). Hopper opening 9" x 4¼".

GRANULATOR No. 4-A

Recommended for at-the-machine operation. Capacity 75 lbs. per hour; 2 H.P. Motor 1200 RPM; Direct drive; Solid semi-steel hopper; High grade roller bearings with positive seals; Standard screen with 11/32" opening (other sizes on order). Hopper opening 9" x 4¼". Overall dimensions 39" long, 18" wide, 42" high. Net weight 500 lbs. with base.

DE MATTIA MACHINE and TOOL CO.

[illegible] REPRESENTATIVE: E. MAYWARD 189 WEST MADISON ST., CHICAGO 2, ILLINOIS

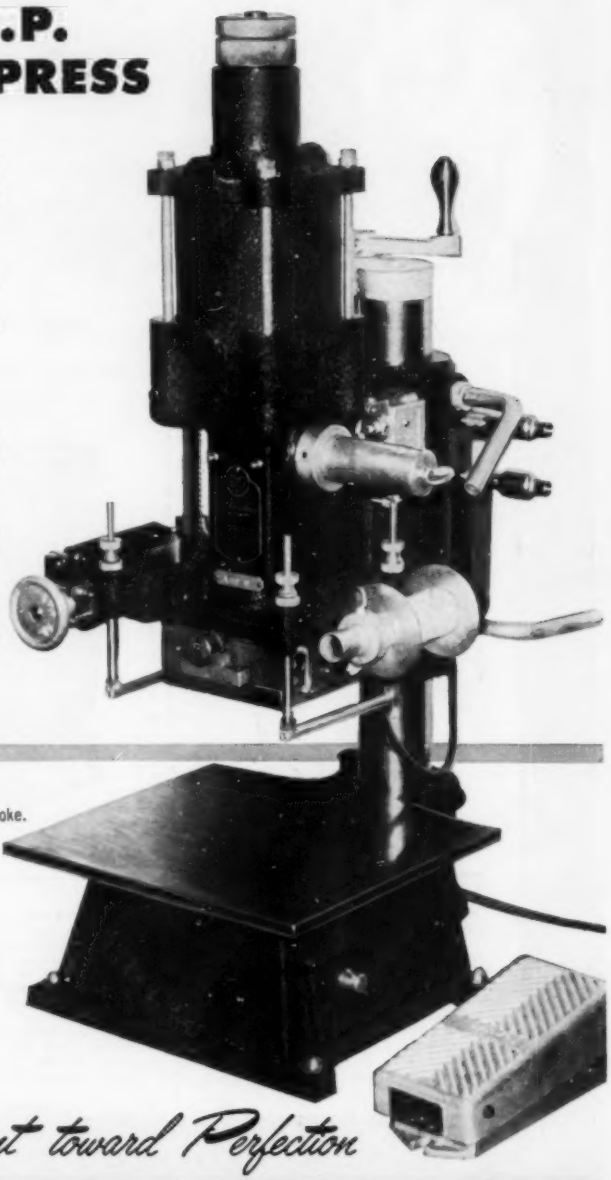
DE MATTIA MACHINE and TOOL CO.

CLIFTON • NEW JERSEY

the new *Peerless*

STAMPING PRESS

AIR-OPERATED MODEL A.B.P. BENCH PRESS



★ **FAST OPERATOR**

for hot stamping on cloth, paper, leather, wood, fibre, soft and hard plastics, hard rubber and most other materials. PEERLESS ROLL LEAF available in gold, imitation gold, aluminum, a wide range of pigment and metallic colors.

★ **AIR OPERATED**

Press has a built in air cylinder which is cushioned at both ends of cylinder to avoid hammer blows on work.
In addition to raising and lowering screw we have included a micrometer adjustment at top of cylinder for adjustment of impression.
Press is equipped with a timing relay for dwell control.

★ **FOOT OR HAND CONTROL**

Foot control, standard equipment, leaves operator's hands free to position articles to be stamped. Also available with hand control. Speed adjustment permits up to 40 impressions a minute, depending on articles and materials being stamped.

★ **AUTOMATIC HEAT CONTROL**

Electrical outlet built into press. Pilot light, thermometer, insure uniform temperature.

★ **AUTOMATIC ROLL FEED**

Adjustable, feeds up to 5" of leaf 4¼" wide. Side to side feed.

★ **BUILT FOR PUNISHMENT**

by Peerless, pioneers in roll leaf stamping.

SPECIFICATIONS

SIZE:
15" wide x 19" deep x 36" high. Depth of throat opening 6" from center of head. 5" maximum opening from die plate to table. 2" stroke.

STATIONARY TABLE:
12" x 11"

AIR PRESSURE:
Not less than 2 h.p. compressor — 80 lb. pressure equipped with 60 gallon tank. Compressor not supplied.
Pressure approximately 19 times line pressure.

ELECTRICAL:
110 volts A.C., unless otherwise specified.

SHIPPING WEIGHT:
220 lbs. Net, 270 lbs. Gross
Head size: 4" x 5"
Die plate size: 4" x 5"
Chase size, inside: 3" x 4"

EQUIPMENT INCLUDES:
lubricator, regulator, strainer and 6 ft. of hose.

Achievement toward Perfection

PEERLESS ROLL LEAF COMPANY, INC.

4511 - 4515 New York Ave., • Union City, N. J.

BRANCH OFFICES: BOSTON • CHICAGO • *Peerless Roll Leaf Division* • GANE BROS. & LANE, INC.
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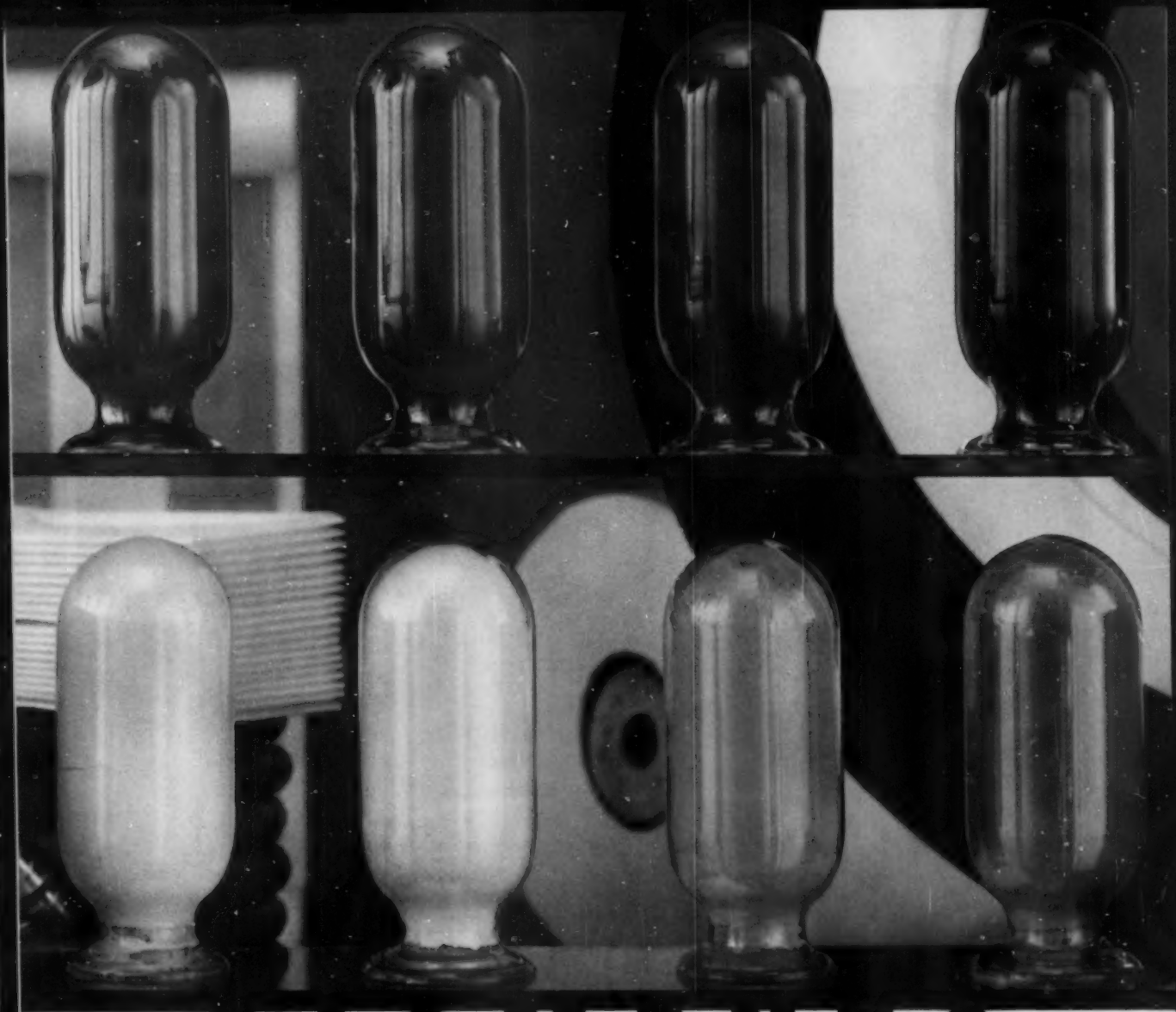

PIGMENTS

How to get the whiteness or color brightness you demand for your plastic products

Glidden pigments are the answer. New *Zopaque* Titanium Dioxide imparts greater lasting whiteness, permits brighter, cleaner tints. Finer, more uniform particles disperse much faster, more easily than ordinary pigments. Millions of tiny crystals scatter light like diamonds, assure highest opacity.

Non-fading, non-bleeding Glidden *Cadmolith* (cadmium-selenium) Reds and Yellows plus new *Mercadmolith* (cadmium-mercury) Reds provide everything you need to give your products maximum color appeal. They are soft, easy to grind, insoluble in all vehicles, and high in heat resistance.

Be sure to specify Glidden—a leading supplier of finest pigments to industry.

By the makers of Sunolith Lithopones . . . Euston White Lead . . . Resistox Copper Pigments

THE GLIDDEN COMPANY

Chemicals • Pigments • Metals Division

Baltimore, Maryland • Collinsville, Illinois • Hammond, Indiana • Scranton, Pa.

QUALITY Glidden PRODUCTS

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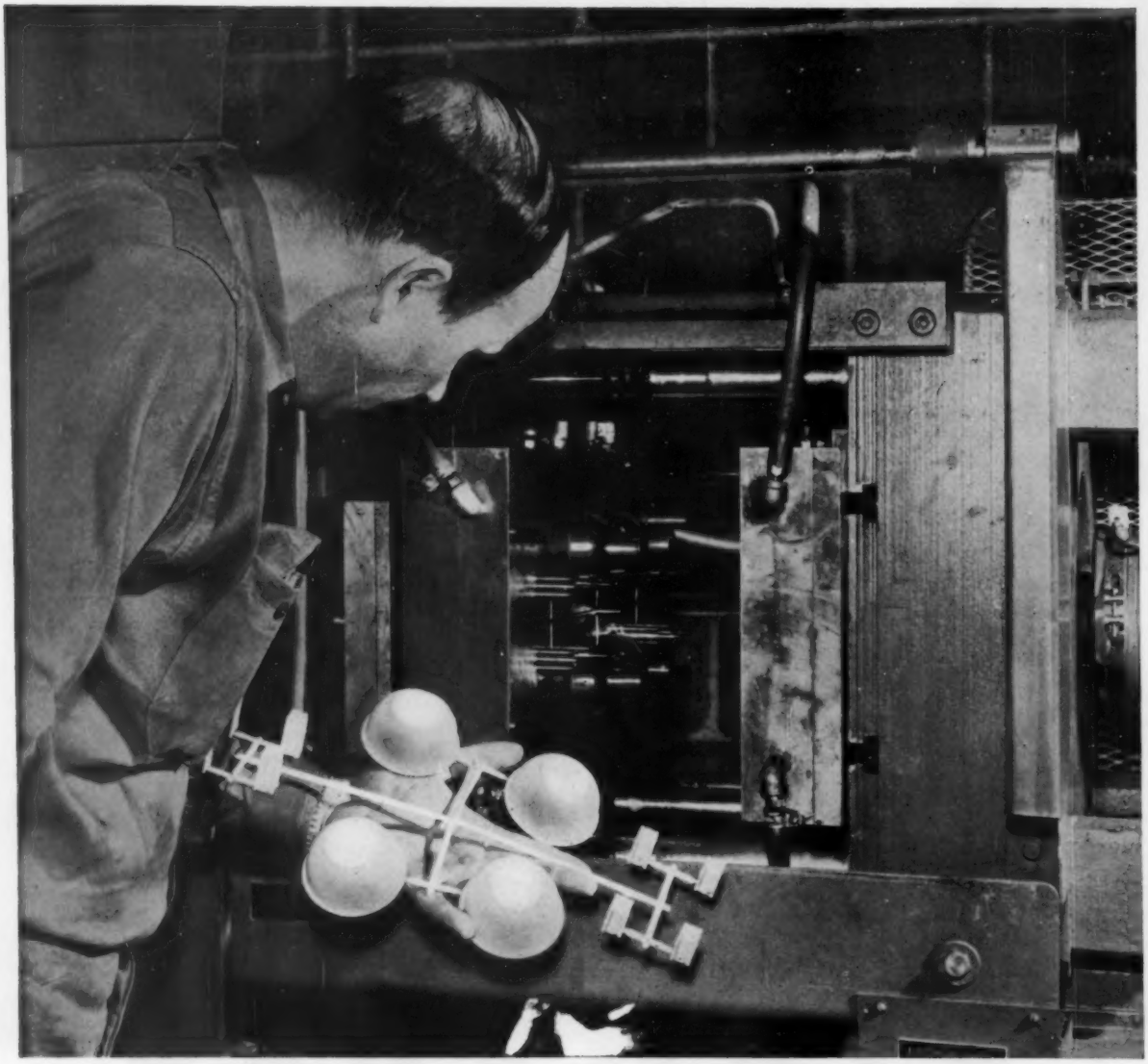


For Long Runs and High Polish They Molded Bowls with Lustre-Die

Long runs and high polish were the main requirements when Chris Kaye Plastics Manufacturing Co., Madison, Ill., began tooling up to produce plastic bowls for a popular blender. The problem was put up to our local tool steel distributor, Ford Steel Co., St. Louis, who recommended Lustre-Die. The die was produced by Lambert Engineering Co., St. Louis.

The result? An economical die in every way, plus a finished product having plenty of eye appeal.

Lustre-Die is an outstanding plastic-molding steel because it takes such a bright polish. Its basic analysis is just right for working with plastics. But as a further precaution, we enhance the grade by means of alloy fortification, thus improving its already excellent properties. It comes oil-quenched and tempered, ready for machining and polishing.

Lustre-Die is an electric-furnace steel. Not only does it undergo close scrutiny to insure cleanliness—it is also free from injurious porosity or surface pitting.

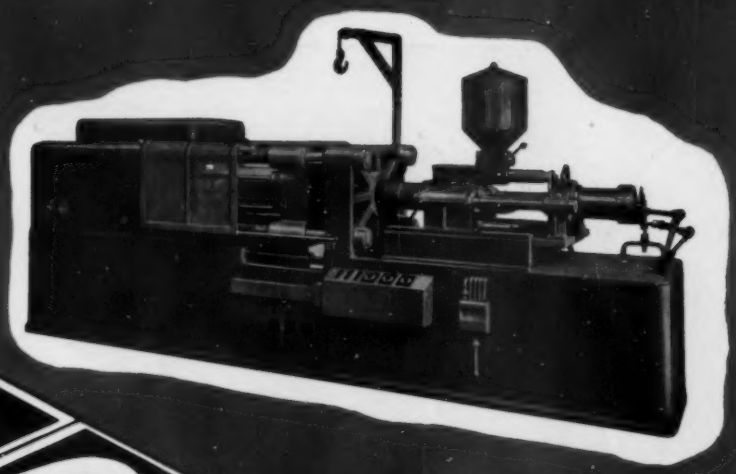
Order Lustre-Die for your next plastic-molding job. Your Bethlehem tool steel distributor has a good supply in stock, and is ready to serve you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEELS

BETHLEHEM STEEL



Injection moulding Machine
capacity: 1, 2, 4, 6, 10 oz.

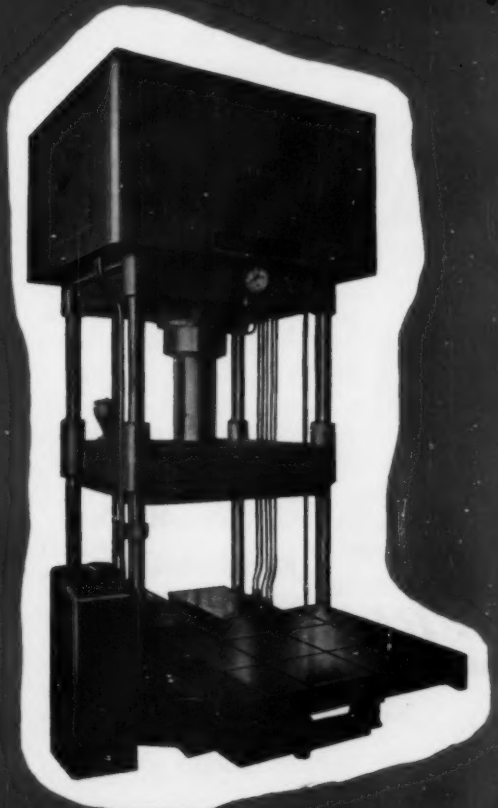
Multiple Platen Press
for Rubber and Lamination
capacity: 52, 100, 200, 300, 600 tons

GBF GBF GBF GBF GB

s.r.l. costruzioni meccaniche

sales office: via Fontana 5 - MILANO - tel. 705.735 - 709.356
works: via Vittorio Veneto 12 - BRESSO - MILANO (Italy)

Low Pressure Press for
Reinforced Plastics
capacity: 35, 62, 100, 200 tons



Compression Moulding Press
for Thermosetting Materials
capacity: 35, 62, 100, 155, 270, 500 tons

Machines for

Plastic

Materials

Astatic Corporation "Economike"

MOLDED THERMOPLASTIC by: Quinn Berry

"WHERE THE UNUSUAL IS ROUTINE"

They said, "it must be rugged, yet light weight, fit the palm of the hand, be immune to temperature extremes and humidity . . . and good looking". A natural for Quinn-Berry engineering designers and master craftsmen. The result—a low cost, mirror finish, quality hand microphone for recorders, paging and numerous general communication uses.

Just one more of the many molded thermoplastic components Quinn-Berry Corporation turns out for a wide diversity of industrial applications.

Your plastic components problem is met with quick, effective solution at Quinn-Berry where "the unusual is routine". It will pay you handsomely to consult with us.

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What's up in closures?

Plastisol Cap Liners made with Low Cost

CITROFLEX A-4 *Plasticizer are Nontoxic... Odor-Free!*

● A good jar can do its job *only* if the lid offers the same protection as the glass.

That means that the sealing ring and liner inside the lid must work efficiently and at the same time be odor-free... nontoxic... completely harmless to *both* fatty and non-fatty food contents.

Nothing meets these requirements better than vinyl plastisol liners made with safe, low-cost Citroflex® A-4 plasticizer.

Citroflex A-4 also finds excellent use in plasticizing vinyls for coating food containers and for producing food wrap films. Citroflex A-2, a companion product, is a nontoxic, odorless plasticizer for cellulose acetate food wraps for both fatty and non-fatty foods. Both Citroflex A-2 and A-4 are accepted by the Food and Drug Administration.

Your Pfizer representative will be glad to explain how Citroflex plasticizers can serve your needs.

Costs of these citric acid esters are remarkably low, compared to other nontoxic plasticizers. Besides A-2 and A-4, the Pfizer Citroflex line includes Citroflex 2 (Triethyl Citrate), Citroflex 4 (Tributyl Citrate) and Citroflex A-8 (Acetyl Tri-2-Ethylhexyl Citrate). Check into the Pfizer Citroflex plasticizers today.

Manufacturing Chemists for Over 100 Years

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The start of the yarn may decide the outcome of your product

Yarn construction is a major factor in the "engineering" of base fabrics!

The construction of the yarn from which a base fabric will be woven pre-determines a number of fabric characteristics. Breaking strength, flexibility, bulking, absorption, and adhesion to other materials are affected by such things as type of fiber, yarn size and weight, twist, plies, and many other factors.

Obviously, engineering proper yarn construction calls for specialized experience, if every detail is to be considered thoroughly, in the light of the base fabric's ultimate assignment. At Wellington Sears, we've had over a century of experience in doing just that. Which is why you can have greater assurance that the base fabric you finally use is completely engineered for *your* job. For informative booklet, "Fabrics Plus," write Dept. K-4.

WELLINGTON SEARS

FIRST In Fabrics For Industry

For Coated Materials, High and Low Pressure Laminates and Other Reinforced Products

WEST POINT MANUFACTURING CO

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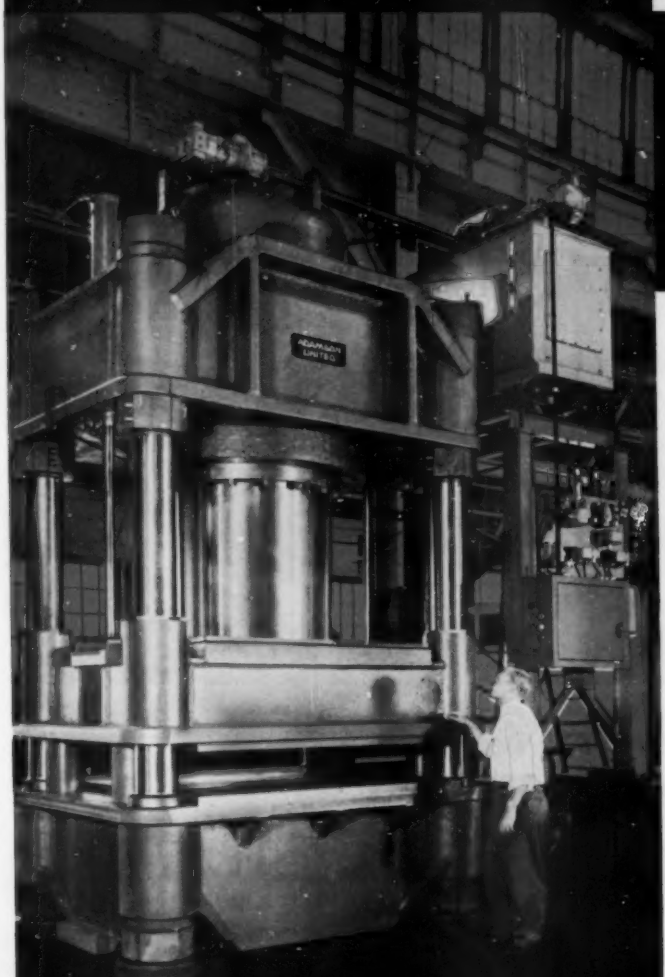
THIS
Adamson United
HYDRAULIC
PRESS



Engineered to customer's special requirements . . .

WAS
DESIGNED . . . BUILT
and TESTED
in less than 6 months

ANOTHER EXAMPLE OF THE ABILITY AND VERSATILITY OF ADAMSON ENGINEERING AND PRODUCTION

Our customer's requirements necessitated an entirely new design of hydraulic press. Starting from scratch, Adamson engineered, built and tested for service, this 1450 ton unit within a period of 6 months.

We have hundreds of standard press designs available, but when something *special* is required, we go "all out" to meet your needs. Every piece of new equipment is thoroughly tested on our erection floor in the customer's presence; and we supply competent technical assistance for first run operations if requested.

Why not talk over your press requirements with us . . . any time . . . without obligation?

Platen Size	76" x 76"
Total Hydraulic Pressure	1450 Tons
Stroke	40"
Daylight	50"
Ram Diameter	40"
Pull-Back Cylinders (2)	6"
Variable Volume Pump	
Compensator Control	

Adamson United Company
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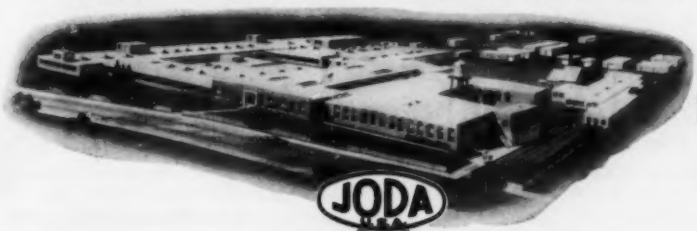

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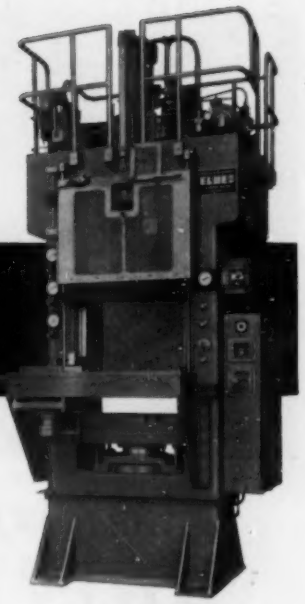

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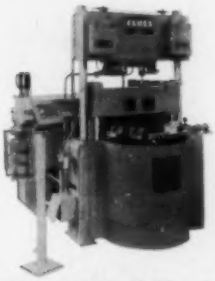

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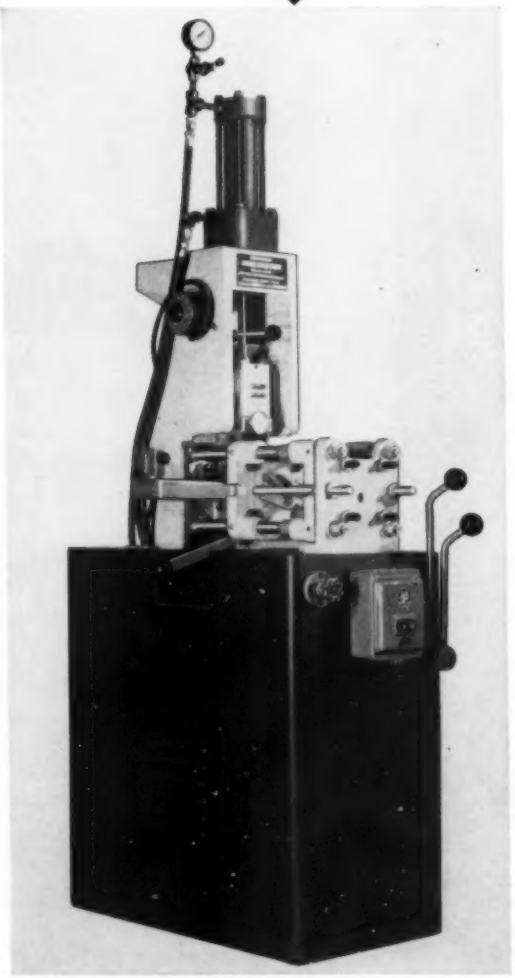
One machine does it all! Eliminates expense of extra equipment and machines; saves high "per-piece" costs of big-press tooling where not required. Ideal for developing and producing widest varieties of small injection molded parts; from precision miniatures to full-size, single cavity items up to 1 oz. Features both conventional production and intricate insert molding in all thermoplastics, including Nylon. Most versatile, flexible machine of its type—at the lowest cost. Adapts quickly, easily to all variables in your most diversified plastic item programs. Learn how the multi-feature "Universal" can be the "work-horse" in your plant for small plastic parts. Write today.



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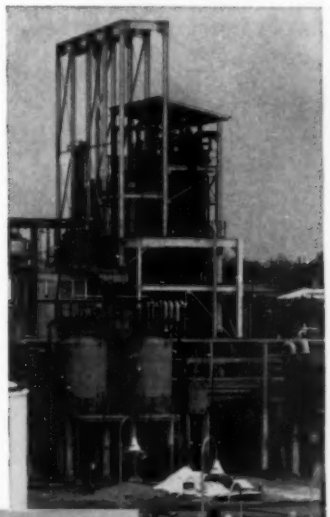
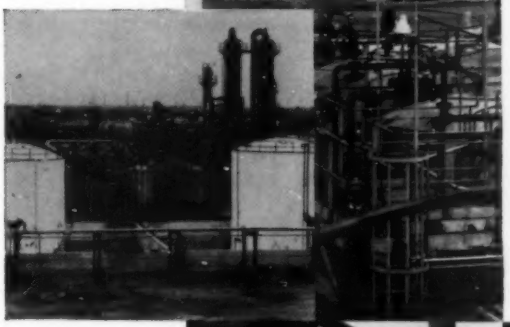
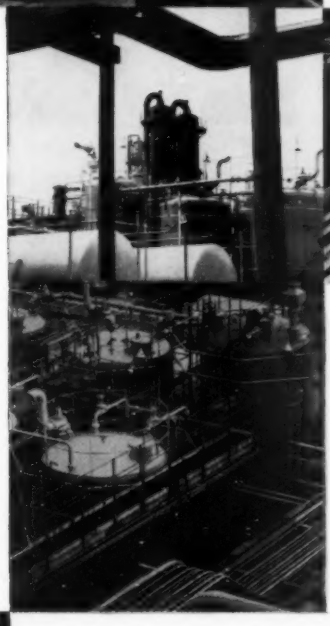
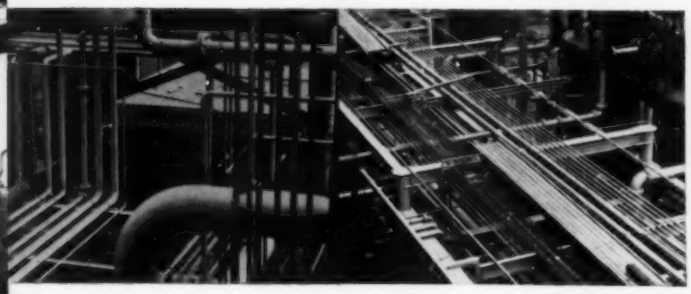
SUPER DYLAN®
polyethylene









Koppers new Port Reading Plant, in New Jersey, is designed to keep pace with current demands. Here, 30,000,000 pounds of high-density SUPER DYLAN polyethylene will be produced annually!

Koppers over-all aim is to serve you with a broad range of melt indicies tailored for specific applications for film, wire and cable, pipe and tubing, injection molding, sheet, filaments, and bottles and blown items.

SUPER DYLAN is now commercially available, and prompt delivery is assured. Information on SUPER DYLAN polyethylene, DYLAN® polyethylene, DYLITE® expandable polystyrene and DYLENE® polystyrene is available. Wire or write, Koppers Company, Inc., Plastics Division, Dept. MP-48, Pittsburgh 19, Pennsylvania.

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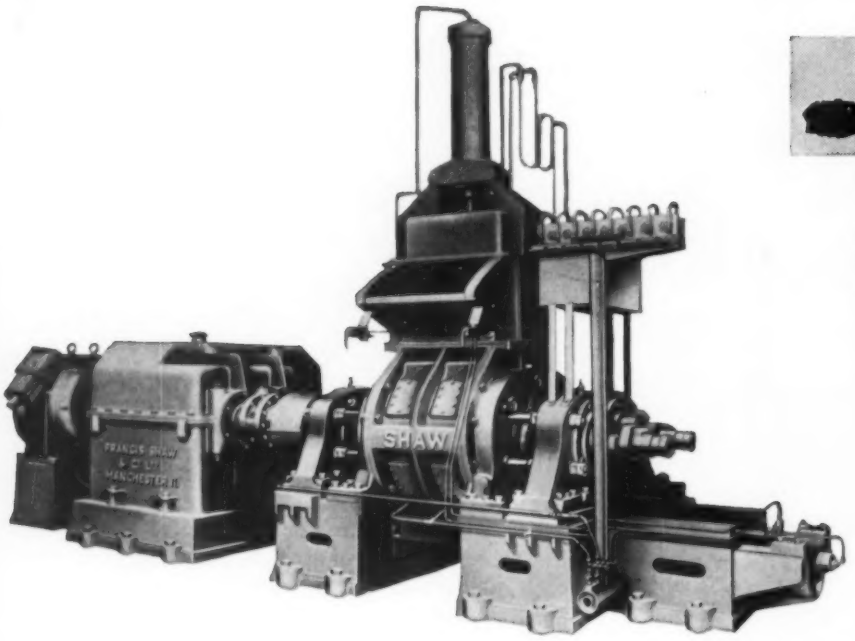

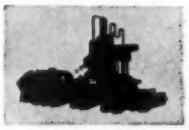

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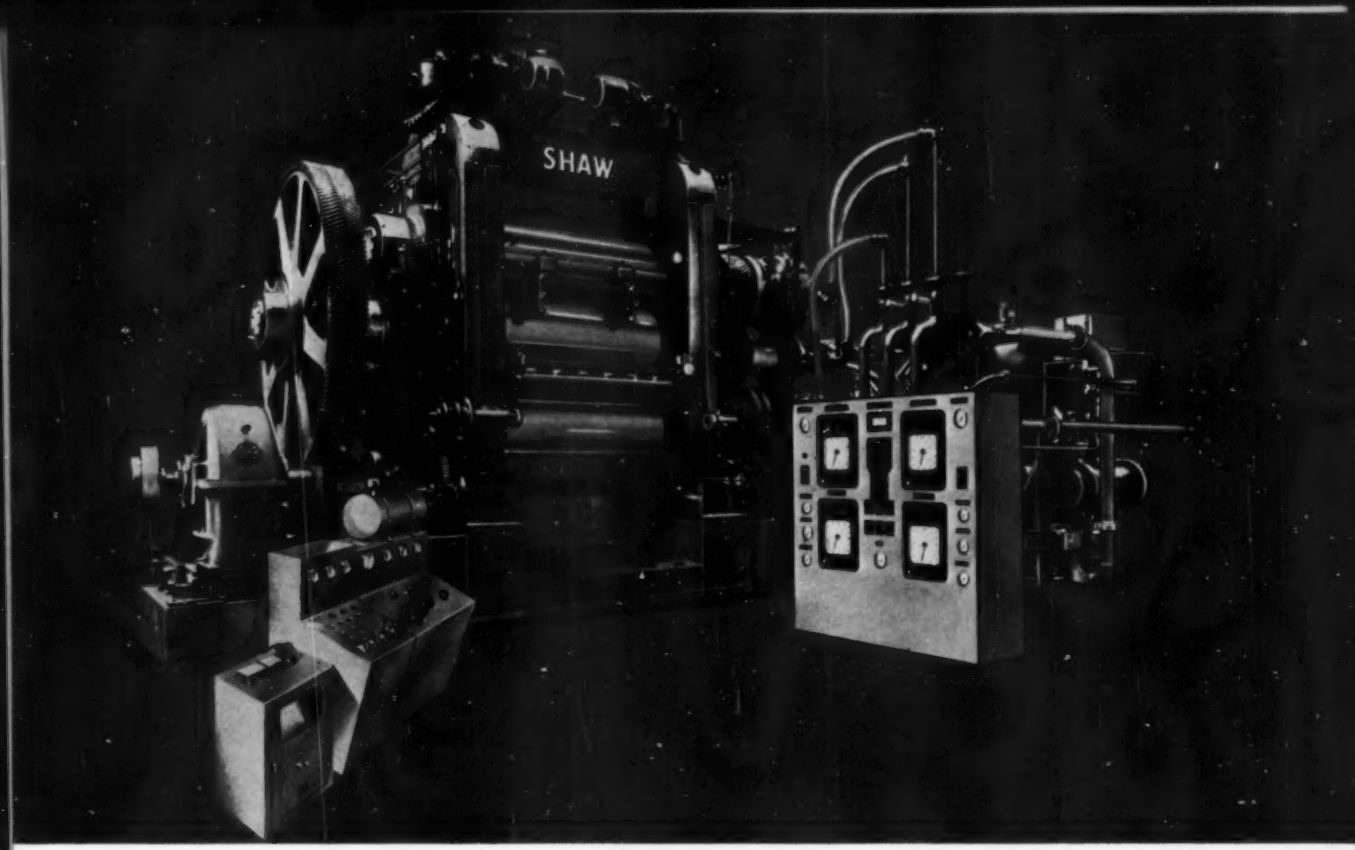
The cost-cutting performance of every Francis Shaw machine and its thorough dependability are the result of long experience and unvaryingly high standards of engineering in every detail of manufacture.

Close-limit accuracy and rigorous inspection during manufacture guarantee to the user a consistently high quality output from Francis Shaw equipment.

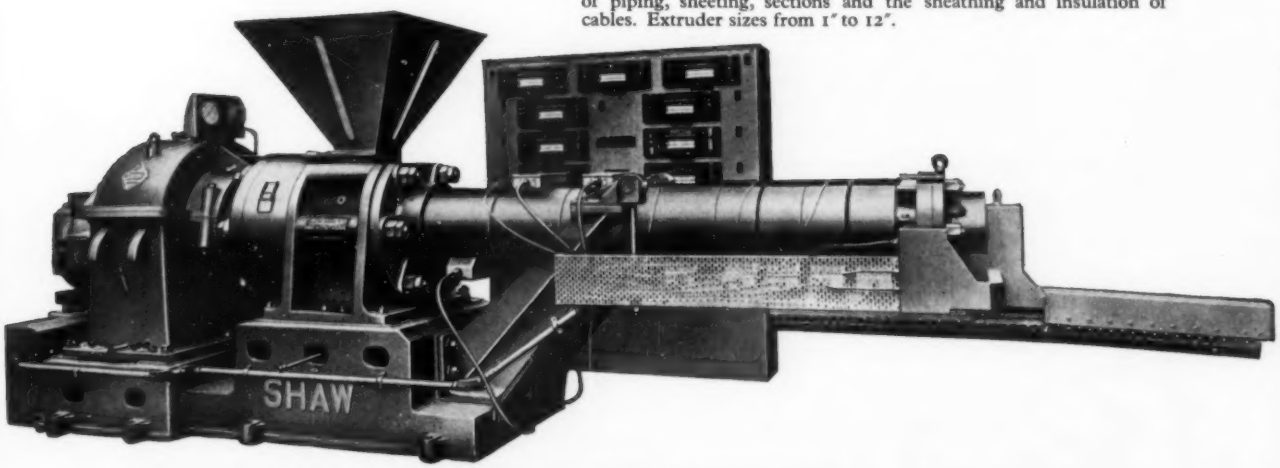
Francis Shaw are available for the design, manufacture, and installation of a wide range of processing equipment



CALENDER. A comprehensive range of Francis Shaw Calenders is available for the processing of all rubber and plastic materials. Flood lubrication and hydraulic roll balancing available on all production sizes. Roll Bending can be fitted as an additional refinement. All sizes available from 13″ x 6″ to 92″ x 32″. Two-, Three- and Four-Bowl Designs.

QUALITY ENGINEERING FOR QUANTITY PRODUCTION

PLASTIC EXTRUDER. Fine temperature control is a vital feature of Francis Shaw extruders. All-electric heating in separate zones is provided, each zone being separately controlled by proportioning instruments. A wide range of screw and die designs is available for the production of piping, sheeting, sections and the sheathing and insulation of cables. Extruder sizes from 1″ to 12″.



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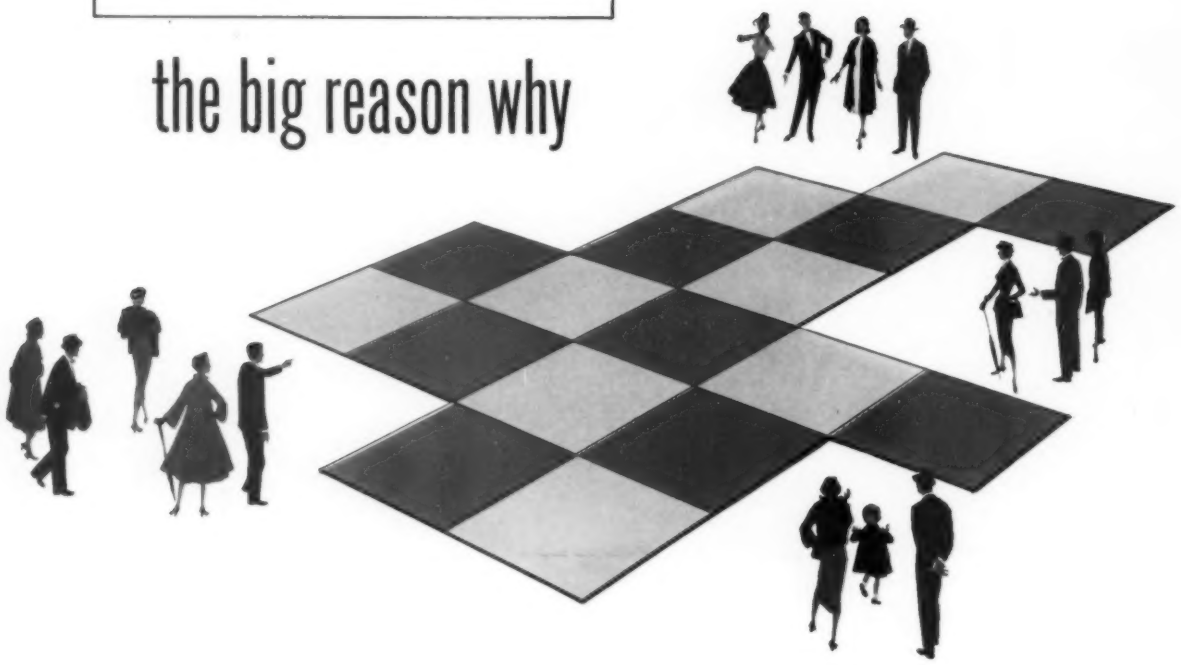

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Plastolein 9720 also offers these cost reducing advantages: low plasticizer cost, relatively high efficiency, low filler absorption, and the efficiencies of easy processing. Also, though 9720 is a polymeric, its relatively low viscosity permits the economies of bulk shipping and handling.

With all these advantages, why not try Plastolein 9720 in your vinyl tile formulations—or in any formulation where permanence is essential.

For complete details on 9720 or any of the Plastolein Plasticizers, mail coupon below:

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Please send 32-page Emeryfacts describing all the Plastolein Plasticizers.

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Don't miss... in this issue

The vast new market in transportation seating. Molded reinforced plastics seats are moving in to replace upholstered metal seats for short-ride operation. They cannot be broken, they cannot be cut, and the potential market in modern buses alone amounts to over 10 million pounds of reinforced plastics. Here is the story on how and why the New York City Transit Authority has switched to reinforced plastics seats. See "Indestructible bus seats," p. 94.

Opportunities for film in fields long held by paper. Prime example is in the dry cleaning market which has a potential of 10.8 billion sq. ft. yearly by the use of inexpensive machines for production of polyethylene garment bags on the spot. Polyethylene is now cheaper than cellophane and in some areas compares favorably with the cost of paper bags. It is moistureproof, flexible, and transparent. How this market is being opened is told in "Dry cleaning: big new market for film," p. 106.

The first full story on polycarbonate, an outstanding new thermoplastic resin. With high impact strength, excellent dimensional stability and resistance to moisture, superior heat resistance up to 300° F., and good electrical properties, this new resin brings new opportunities to the thermoplastics field. Here is how it is made, how it is applied, plus a full presentation of the properties. See "Polycarbonate resin," p. 131.

Our "cover story" on developments in and prospects for plastics in agriculture. Here is a picture of a growing field for various types of films, sheets, coated fabrics, and pipe. Mulches, crop covers, frost protection, greenhouses, pond liners, silos—all are using big amounts of plastics. Here is proof that plastics in agriculture can lower manpower needs, help grow bigger and better crops, and save water. See "Plastics' stake in agriculture," p. 91.

The spiral mold for high-density polyethylene. This test mold is so designed that the engineer can see where the material travels, at what speed, and in what condition. It is a new technique to show the difference in flow properties between the new types of polyethylene and the low-density types. From information obtained, recommendations can be made for proper mold design to obtain satisfactory shots on economical cycles. See "Molding linear polyethylene," p. 122.

Having problems with intricate product design? Mold designers often curse product designers because of the problems presented in draft, wall sections, radii, undercuts, etc. Here are two case histories of complicated jobs and the molds designed to produce them. Here is how tough problems were overcome by ingenuity and common sense. See "Effective mold design," p. 111.

Interesting new developments in electronic welding. Bigger machines with higher output and huge dies on the one hand and smaller, more versatile machines on the other hand are enabling designers in many fields to produce beautiful and durable products with economy. Almost every end-use field is involved, from wallets to raincoats, to automobile door panels, to furniture, to swimming pools, to tarpaulins, to air houses. See "Hot subject: heat sealing," p. 85.

The latest progress report on vinyl-metal laminates. Introduced only four years ago and first discussed in MODERN PLASTICS, this combination of materials increased in volume from 1 million sq. ft. in 1955 to 18 million sq. ft. in 1957. By 1960 volume is expected to reach 140 million square feet. The latest techniques of laminating, fabricating, welding, and finishing; a number of interesting new applications; and a detailed account of what is being done in the field and by whom will be found in the article "Vinyl-metal laminates—up 1800% in two years," p. 102.

Watch for... our May cover which, in honor of the National Packaging Show, will feature "Plastics' stake in the packaging field;" an article on "Tomorrow's plastics packages" will be a highlight of the issue . . . for May also, that long-promised study of the challenge offered by wood-flour filled urea; not much used here, this material has been successful abroad . . . the present picture in polyethylene pipe . . . a new use for general-purpose phenolic in blower wheels for the air conditioning field . . . a detailed article on how to machine Teflon . . . in June a major lead on applications for high-heat resistant plastics; developed mainly for missiles, these remarkable combinations of materials (some have stood up to as high as 9000° F.) are being studied by end-use industry and you may be using them in the future . . . and still more information on new plastics and combinations of plastics, new processing methods, and new ways to use plastics for profit!

MODERN PLASTICS
Volume 35
April 1958
Number 8

Hot subject: heat sealing

Electronic welding of vinyl film and sheet has now become big business with products designed for the process

One of the most convenient things about vinyl is that it can be heat-sealed dielectrically. This fast, low-cost fabrication technique, which rapidly produces an excellent bond, started out as a replacement for sewing which is unsatisfactory with vinyl because the needle creates tear holes. Today, basic industries such as furniture and automotive are designing many products specifically to take advantage of dielectric heat-sealing.

We've come a long way from the techniques and equipment which produced the heat-sealed vinyl wallets of post-World War II days. Wallets are still with us, but electronic sealing has become a big-scale, highly automated business, producing a multitude of articles ranging in size up to mattresses and automobile door panels . . . and literally by the mile.

The same basic principles used in the early days are still employed—simultaneous penetration of the material radio waves and application of mechanical pressure. The changes have been largely evolutionary: bigger presses, more powerful generators, bigger dies, and more sophisticated methods of bringing the material up to the dies.

The old single hand-fed machines, though still turning in good performances in many places, are giving way to roll-fed automatic hook-ups that take a product through the complete stages of sealing, embossing, and removal of excess material. The 2-kw. semi-portable sealer that was typical of the industry a decade

Spectacular, air-borne military recruiting "poster" makes use of an electronically welded, inflatable balloon, fabricated to resemble a parachute. Inflatable paratrooper is also made of heat-sealed vinyl. Display is kept aloft with helium. (Photos, Plastic Creators, Inc.)

ago has grown to 5 or 6 kw. Even these machines are dwarfed by the 50- and 75-kw. units available today.

Along with the maturing of manufacturing processes has come a broadening of the economic base of electronic heat-sealing. A survey conducted by the market research firm of Smith, Stanley, & Co., for Radio Receptor Corp., New York, N.Y., leading manufacturer of equipment, found that 67.5% of the total vinyl film and sheeting consumed last year—165 million lb.—was fabricated by electronic welding. This works out to 111 million lb. of material processed through the sealing dies. The study showed that about 20 different industries employ dielectric sealing, of which the largest users are toys, novelties, rainwear, closet accessories, and luggage. Almost 8000 pieces of equipment are in use.

Name change

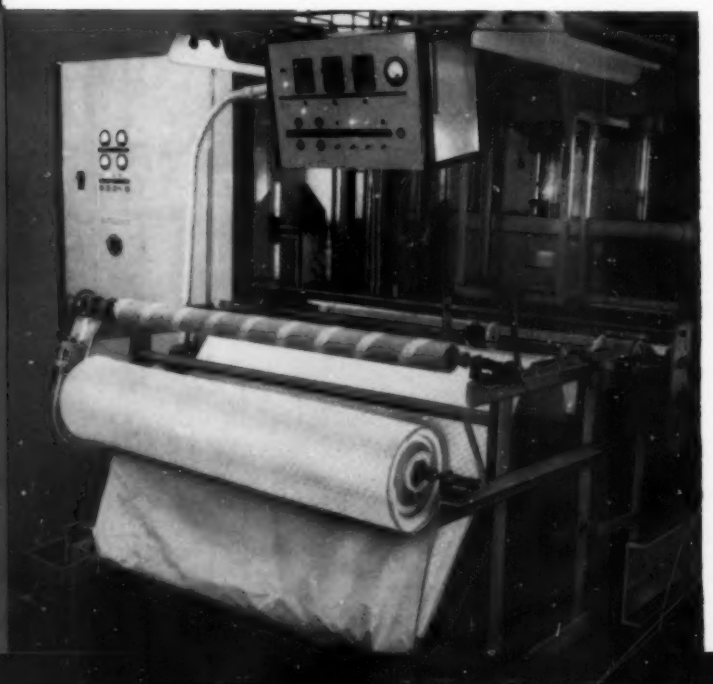
Note the change in nomenclature in the above paragraph. Heat-sealing is not a good term to describe the process. As Ivan Schwartz, sales manager of Radio Receptor, points out, the correct term to use is electronic welding. Here's how the process works: as the radio waves from a high-frequency generator pass through vinyl, the molecular friction generated in the plastic heats and melts the material, whereupon the pressure exerted brings about a thorough fusion. As the material solidifies, a complete weld is achieved. This bond, properly made, is at least as strong as the material itself. (For a technical review of the process see "Electronic heat-sealing," by Robert D. Farkas, MODERN PLASTICS 35, 109, March 1958.)

With the recent perfection of the arc suppressor, or "snuffer," a big obstacle in the path of electronic welding has been overcome. This device virtually anticipates an arc, cutting off the generator's power in one-millionth of a second—long before it can damage the valuable dies. The suppressor can be described as an electronic switch triggered by a low-voltage current passing through the arc.

The technical advances in electronic welding have virtually all come from two sources—the machinery manufacturers and the die makers. These groups are quite separate—that is, with

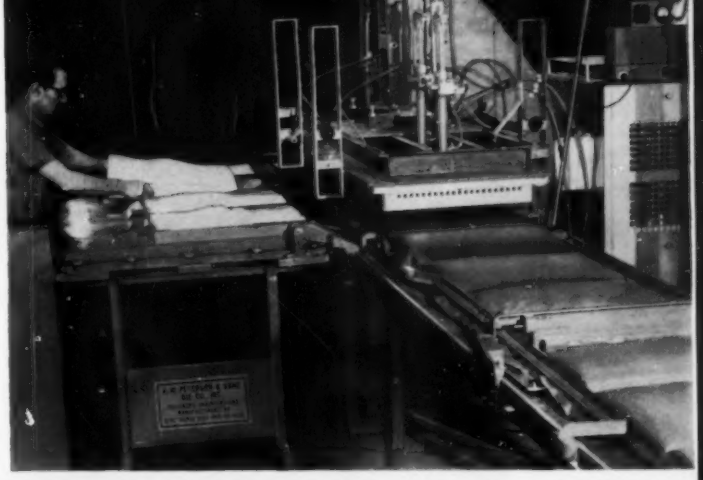
Quilting by the mile

Two layers of vinyl sheeting and one layer of cotton batting are fed to die, which embosses and seals an area 54 by 12 in. in one operation



Electronically quilted material is rolled up on take-off spool. Equipment is continuous and automatic. (Photos, Guild Electronics)

Big investment for big production



Operator feeds 4-in.-thick fibrous glass pads into loading trays for positioning between two vinyl sheets in machine at right. In press, area between pads is welded and tear seal made around the entire mattress

Heat-sealed mattresses, finished except for removal of excess material, emerge at right end of machine

One mattress per squeeze

Mattress is durable and waterproof, can be used on chaise longue, in the yard, or on the beach. (Photos, A. W. Peterson & Sons)

few exceptions, equipment makers do not manufacture dies—and this specialization, though it can complicate the life of the producer of a welded product, has probably resulted in faster technological progress.

And the progress has been great. Consider 50 kw. for a moment. It is enough power to operate a medium-size radio station, or 40 bread toasters. It is also enough to form four finished vinyl trim panels for automobile doors with one quick squeeze of the press. This happens every 30 sec. at the Owosso Mfg. Div. plant of Mitchell-Bentley Corp., Detroit automotive supplier, with a 50-kw. Radio Receptor generator and a 100-ton hydraulic press.

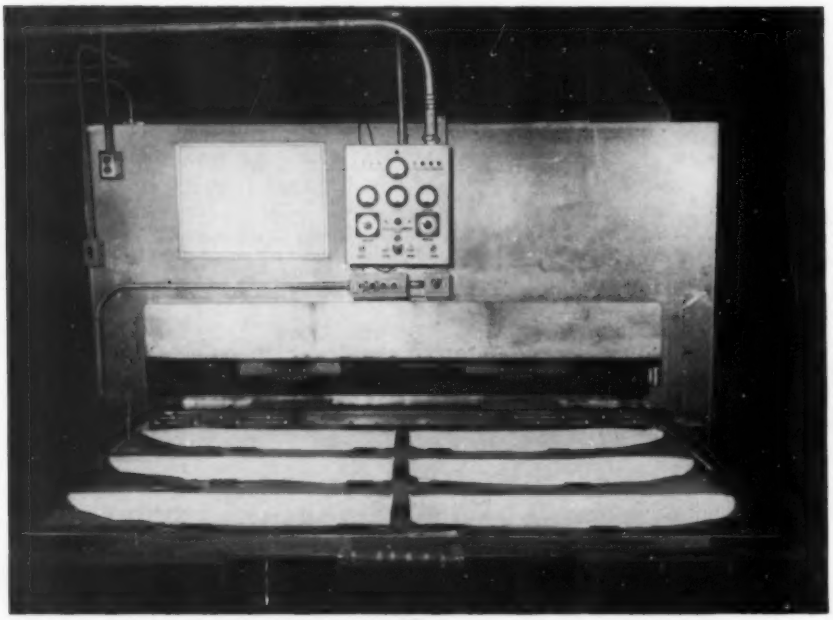
Another manufacturer who supplies the automotive industry with large presses is Girdler Process Equipment Co., Louisville, Ky. Girdler has machines in the field that can form and emboss a complex door panel in 10 seconds.

Other products for the auto industry being formed by electronic welding include interior head linings, upholstered seats, safety visors (foamed vinyl with a skin of vinyl sheeting), tool kits, and gasoline filters. Another product on the drawing boards of one of the auto makers has all the insiders excited: it's a convertible top made of vinyl-coated fabric.

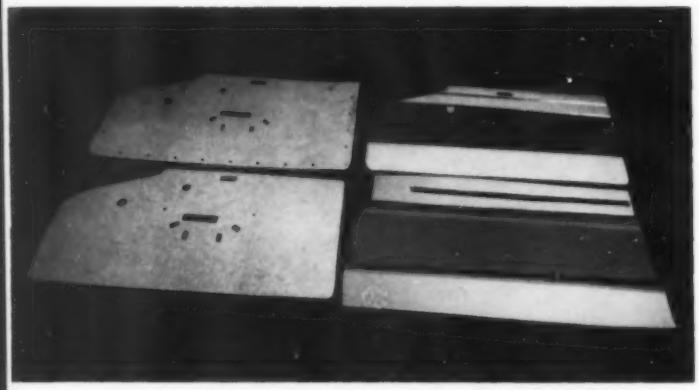
Small dies, many passes

The most impressive-looking products of electronic welding—tarps, swimming pools, etc.—do not involve large dies. They are generally made with many passes of a small die. This is how Bilnor Corp., Brooklyn, N. Y., and Ideal Toy Co., Hollis, N. Y., two leaders in the inflatables field, usually produce their products. Bilnor feels that a better seal can be obtained by a good operator with repeated passes of a small die, because of the difficulties of main-

Big investment for big production



Six sections of auto door panels are loaded in 100-ton Thermatron press at one time. This huge piece of sealing equipment is powered by 50-kw. generator



Component parts of typical heat-sealed door panel: die-cut composition board (upper left); sheet of tufting (lower left); vinyl covering material with metallized Mylar film strips (right). (Photos, Radio Receptor Corp.)

Wide range of design possible with electronic welding is illustrated by door panels below. (Photo, Girdler Process Equipment)

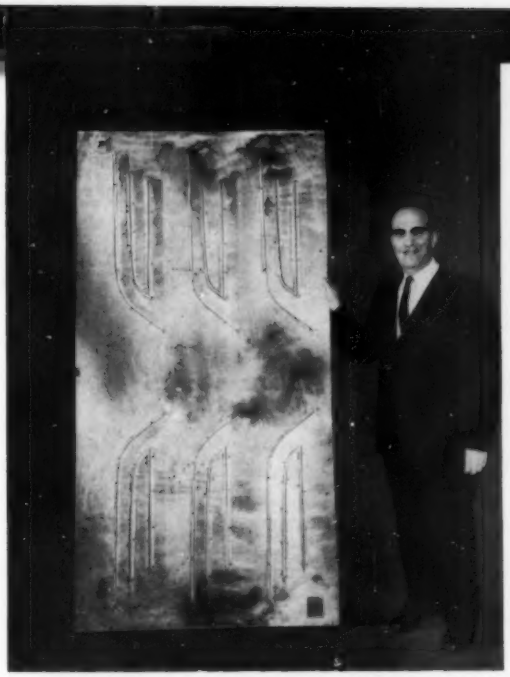
taining uniform power distribution and dimensional tolerances in a large die.

Large pieces can be fabricated with a small die by two other methods: the rotary sealer and the table arrangement. The rotary sealer, offered by Mayflower Electronic Devices, Inc., Little Ferry, N. J., looks just like a sewing machine, and is handled just like a sewing machine, with a revolving disk electrode in place of the needle. Mayflower also manufactures the straight bar type of equipment.

Another approach to the problem is the table arrangement, in which the welding is done right on the layout table. Produced by Electronic Processes Corp., San Francisco, Calif., the equipment consists of a long table with a lengthwise slot, a pair of electrodes (that are also electro-magnets) which are mounted on a belt, and a pressure bar. The belt-mounted electrodes travel along the slot in the table, and the bar, which rides on top of the seam being made, exerts pressure on the vinyl by virtue of the magnetic attraction of the electrodes. The high-frequency field from the side-by-side electrodes heats the vinyl and, with the pressure of the bar, produces a series of solid welds, each 36 in. long. (See pictures, p. 90.)

Big dies, big generators

All of these methods are inexpensive and versatile but when a large area must be welded and embossed at the same time, either to speed production cycles or do a job too complex for

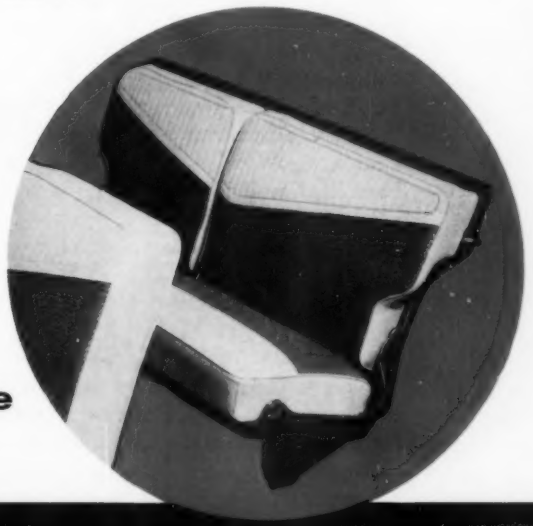


Large die for sealing six sections for auto door panels illustrates the sizable areas that can be sealed with one squeeze in modern equipment. (Photo, Mitchell-Bentley)

the A & S Steel Rule Die Co., New York, N. Y.

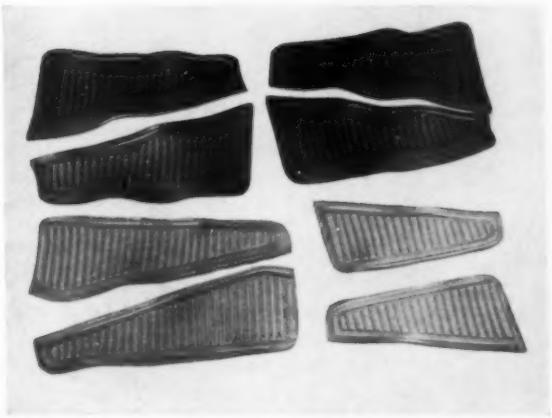
Another big die is being used to manufacture a full-length mattress for a chaise longue. The mattress is made in four sections of vinyl sheeting stuffed with fibrous glass. These mattresses are produced by Nappe-Smith Mfg. Corp., Farmingdale, N. J., on a highly automated, roll-fed set-up. (See pictures, p. 87.) These dies, as well as the advanced system of jigs and fixtures that bring the material up to the dies, were produced by A. W. Peterson & Sons Die Co., New York, N. Y. A very similar mattress

Finished inserts on automotive seat back, produced by latest embossing-heat sealing techniques, lend air of elegance to modern car interior

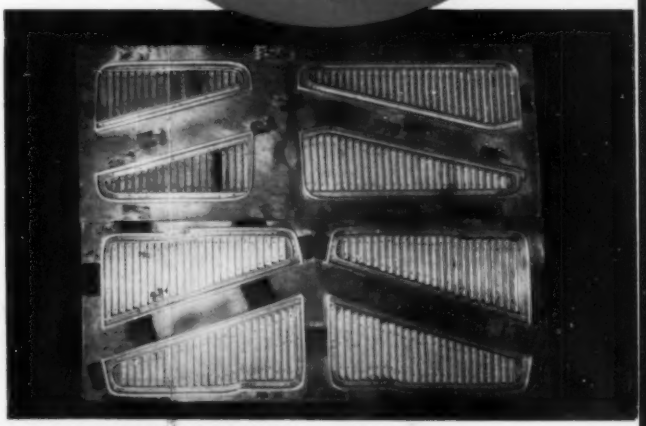


hand work, the only alternative is a big die, which demands a large press and a powerful generator, and is proportionately expensive. Such was the selection of two companies now making inflatable beach mattresses with 72- by 30-in. dies—Carson Glove Co., San Rafael, Calif., and Sigmund Werner, Bloomfield, N. J. Dies for these jobs were manufactured by

Eight at a time



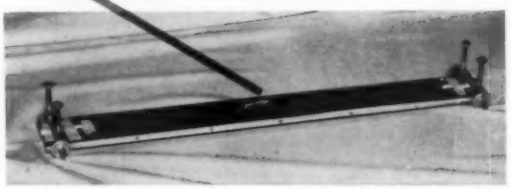
Inserts for car seat backs consist of foam rubber and vinyl-coated cloth, electronically welded together and embossed, eight at a time



Huge precision-machined die to weld seat back inserts is produced in two sections. (Photos, Radio Receptor Corp.)

Table that welds

Sealing can be done right on layout table. Electrodes are in a magnetic bar that rides in slot in table, carrying pressure member (right) along on top of table. (Photos, Electronic Processes Corp.)



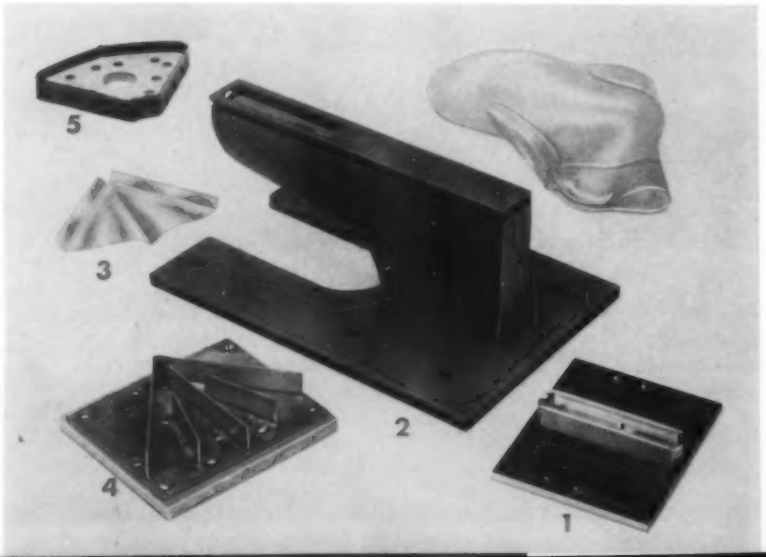
is produced by Crawford Mfg. Co., Richmond, Va.

Among the most interesting recent developments in electronic welding have been the welding of plastics other than vinyl. Foamed vinyl, of course, behaves just like sheeting and has never presented any sealing problems. And more recently, acetate and butyrate have been heat-sealed, a potentially far-reaching development because these materials are the backbone of the blister packaging field. Erdco Engineering Corp., Addison, Ill., offers equipment that will seal acetate or butyrate blisters to backing cards coated with the same material. Going a step further, Erdco has developed a machine which 1) vacuum forms blisters on a continuous basis; 2) electronically seals backing boards to blisters, after product has been loaded; and 3) die-cuts blisters apart.

Now, on the forefront of electronic welding technology, four other plastics—all of them with desirable properties—are being successfully welded to themselves. The first of these is polyurethane foam. That's right, polyurethane; skeptics may line up at Guild Electronics, New York, N. Y., for a demonstration. This company reports intense interest among foam manufacturers in electronic welding. There ought to be, because for certain markets, like novelties, toys, and household products, it is an indispensable production method.

Fluorocarbon film (Minnesota Mining and Mfg. Co.'s Kel-F) is being welded in preparation for a commercial packaging application, in which the film will be used to hold individual hypodermic shots in transparent containers heat-welded at both ends.

Nylon film can also be welded. It is temperamental, but with care an excellent seal can be obtained. The chief idiosyncrasy (*To page* 204)



Curved seal, which welds tongue and zipper to rain overshoe, is produced with special die (1) and buffer jig (2) over which transparent boot is slipped. Tongue for shoe (3) is tear-sealed and gusseted by die (4) against buffer plate (5). (Photo, A & S Steel Rule Die Corp.)

Plastics' stake in AGRICULTURE

Row crop covers, fabricated of 36-in. strips of clear polyethylene film joined at the top of a wire wicket, permit early planting, speed growing. (Photo, Spencer Chemical Co.)

The agricultural industry in the United States, with an annual gross of over $33 billion, encompasses some 1,165,000,000 acres of arable farm land—and every one of these acres is conceivably a potential market for plastics materials. From the field experience gained in the past two to three years, and from the extensive research now going on in agricultural schools and universities all over the country, the farmer is beginning to realize the extent to which plastics can contribute to his three basic needs: increased productivity, lower costs, and better working conditions.

As a result, there was a marked swing to plastics for agricultural uses in 1957. Some of the estimates for the future are already reaching tremendous proportions. Estimates for use of plastics film and sheeting for agricultural applications in 1965 range from 100 to 375 million pounds. The final figure will probably fall somewhere in-between, but, from all current indications, it seems unlikely that the figure will dip below the 100 million-lb. mark.

How the estimate will break down for specific plastics is another question. Polyethylene and vinyl film are currently jockeying for top

Plastics pond liners and irrigation ditch liners, which can cut amount of water seepage to negligible figure, shape up as big future market for film materials—particularly in light of current emphasis on water conservation. Pond liner shown above is fabricated of polyethylene film and is spread out in the pond bed. Dirt back-fill is used on the edges of the film to hold it securely in place. (Photo, Spencer Chemical Co.)

position; coming up in the rear are oriented styrene-acrylonitrile copolymer sheet and, more recently, polyester film. It will be a question primarily of cost and suitability that will determine how much of the market each material will obtain. At present, polyethylene film seems to have the edge in mulching applications and vinyl film the edge in pond and irrigation ditch liners.

Diversity of applications

As shown in this month's cover by Weimer Pursell, plastics agricultural applications cover a wide range—including greenhouses, mulches, silos, pipe, and wrappings for balled roots. The applications discussed here represent those with the largest volume potential. Although they have already received considerable publicity (see "Plastics' Green Thumb," MODERN PLASTICS *34*, 89, July 1957), they are only now coming into a fairly general acceptance that indicates they will comprise the big agricultural markets of the future.

Mulches: To retain moisture and heat in the soil, retard the growth of weeds, and guard against mold rot, plastics film mulches are outstanding. As one case in point, a 4-acre melon farm reported a two- to three-fold increase in yield and a two-week earlier ripening as a result of using a black polyethylene film mulch. Cost of the film was about $120 per acre—a fraction of the extra profits on the first harvest.

Some experts predict that about 25% of the polyethylene and vinyl film being used for agricultural applications will go into mulching.

Inexpensive machine for laying black polyethylene film mulch can be attached to conventional cultivators. (Photo, Bakelite Co.)

There are some mighty impressive figures to back this up. One manufacturer, confining his comments to the Hawaiian pineapple crops, calculated that the acreage replanted each year will require 3 million lb. of light-gage film (thicknesses of 1½ to 2 mil are generally used for mulching). Another estimate has it that some 8 million acres could use plastic film mulching.

Variations in this mulch category that should not be overlooked include plastic film with pre-cut holes for planting and grid-printed films to facilitate better spacing.

Silos and silo covers: Although the concept of plastics film silos is several years old, it first really caught on in 1957 and conceivably can soon start rivaling mulches as a volume consumer of plastics materials. In the dairy industry alone, it is estimated that from 20,000 to 25,000 conventional vertical silos and 1200 horizontal silos are built annually. If polyethylene and vinyl film get as large a share of this market as they anticipate, the poundage figures could be startling.

The advantage of silage as a fall and winter cattle feed has long been recognized. It is estimated that two acres of feed crop properly ensiled equal that from three acres made into hay. The question, therefore, has been how to provide this ensilage economically and simply. Plastics films, whether used as a cover for a trench silo or as a cover for feed stacked in a field, have proved to be the answer. The cost of even a large trench silo cover is small when compared to the $7000 to $10,000 investment in conventional equipment and silo facilities. In most cases, the savings made possible by preventing spoilage more than pays for the cost of the covers. For example, the spoilage of 400 to 500 tons of ensilage stored in an unprotected trench measuring 16 by 90 feet would normally represent a loss of about $335. In contrast, it would only cost about $150 to cover the trench completely with vinyl film.

Polyethylene and vinyl film can also be used to cap standard silos to effect an air-tight seal. A flexible polyester-fibrous glass cap can also be used for the same purpose.

Greenhouses: The use of plastics for greenhouses is again based on economy. It has been calculated that a glass greenhouse may cost up to 10 times as much for materials as would one based on plastics films. Construction, of course, is also much easier, since the films are either nailed or adhered to a simple wooden frame. And, finally, it is claimed that the greater moisture retention and lower heat loss at night in a plastic greenhouse give greater yield and better quality crops than would be possible in a glass greenhouse.

Among the film materials, polyethylene and vinyl have both been vying for top honors in this market. Last year, an oriented styrene-acrylonitrile sheet was introduced which appears to have excellent properties for the application and which (*To page* 215)

Experimental greenhouse covered with a weather-resistant polyester film can be built at ¼ the cost of glass greenhouse. (Photo Du Pont)

Spoilage was reduced to less than 3% by use of an 80-ton outdoor silo fabricated of vinyl film. Normal spoilage averages 16 percent. (Photo, Bakelite Co.)

Interior view of new bus, showing reinforced

Indestructible bus seats

Reinforced plastics passenger seats minimize vandalism, reduce initial and maintenance costs, provide adequate rider comfort

The undisputed supremacy which upholstered bus seats have enjoyed for many years is now being seriously challenged by seats molded of reinforced plastics. The bridgehead for this battle of the buses has been established in New York City, where the Transit Authority has placed into regular service the first buses with molded glass-reinforced polyester passenger seats.

At stake is a multi-million dollar market with nation-wide and multi-industry ramifications. Latest available figures on the number of urban motor buses in the United States put the total at 51,400. With an average of 40 seats per bus and an average of 5 lb. of reinforced plastics per seat (about 45% resin, 25% glass, and 30% filler), this represents—at 100% penetration—an initial market potential of over 10 million pounds. In addition, there is a replacement market which over the past 15 years has averaged 3500 buses per year and thus constitutes an annual potential of 700,000 lb. of reinforced plastics. If other means of urban transit are included—surface railway cars, subway and ele-

Interior view of new bus, showing reinforced plastics seats and decorative melamine laminate ceiling. Semi-circular seats in rear are produced by hand-layup, others are match-metal molded. (Photos, NYCTA)

vated cars, and trolley coaches—these market-potential figures for reinforced plastics are approximately doubled.

According to Col. James B. Edmunds, Gen. Supt. of Service of the Authority, the situation in New York is as follows: 209 new buses with reinforced plastics passenger seats are now running; 121 more have been ordered; and Authority plans call for the gradual replacement of all the 2000-odd buses it operates with vehicles featuring RP seats.

Why the switch to RP?

The primary reason for going from upholstered to molded reinforced plastics seats was vandalism. The repair bill footed by the New York City Transit Authority for damage from this cause alone has been running at an annual clip of about $100,000. It is anticipated that much of this expense will be eliminated as a result of the switch to RP seats . . . which can be vandalized only through practically superhuman effort.

A further consideration was maintenance. Even when not abused, upholstered seats present formidable service problems: seams open, springs become dislocated, cover material cracks. With molded plastics seats, there are no seams, no springs, and no cover materials to cause trouble.

Finally, there is price. Despite a sizable investment in tools, the initial cost of RP seats is still somewhat less than that for the upholstered variety.

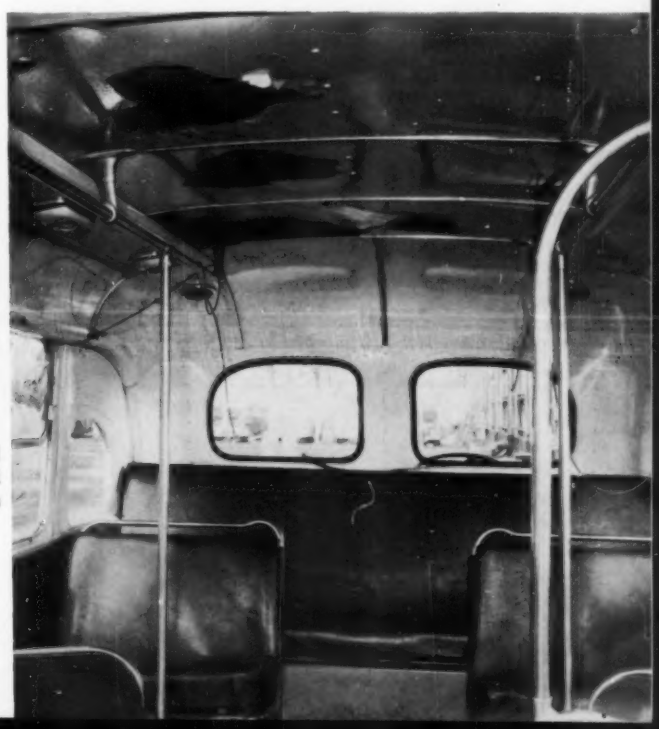
What do passengers think?

Before placing them into regular service, TA spent considerable time in passenger reaction tests. Results were overwhelmingly in favor of the new seat.

One of the questions the TA wanted answered in these tests was: will the rider object to the fact that, unlike its upholstered counterpart, the RP seat is non-yielding. The answer was "no." Because of the bucket-type, contoured construction of the RP seat, and because it is spring-mounted on its steel frame, passenger comfort is not appreciably diminished. This is particularly true of air-spring buses.

Acceptance of the new seat is based on short-ride experience. The TA questions the suitability of using RP seats in long-distance transportation; in fact, the drivers, who are at the wheel for extended periods, are provided with well-upholstered seats.

Three models of seats are involved in the New York buses: single- and double-bucket, and semi-circular well (for the rear of the bus). Their production does not involve any unusual manufacturing techniques. The single- and double-buckets are match-metal molded. The



Examples of typical vandalism on standard upholstered seat (above) and regular painted ceiling (right) in old New York City buses

wells are produced by hand-layup.[1] All seats come in an integral dusty-rose color, quite unusual for buses.

Other plastics uses

In addition to RP seats, the new New York buses use decorative melamine laminate ceilings. While these cost roughly $100 more per bus than conventional ceiling material, the savings resulting from reduced vandalism more than make up for the cost difference . . . and, of course, they add greatly to the interior decor of the vehicle. This paneling, however, is not a new application in the bus field. Buses in other cities have used them both for ceiling and side paneling.

The TA is now experimenting with non-load-carrying reinforced plastics body components, especially for use at the two front corners of the bus, where most of the denting takes place. Panels can be easily molded to the contour of the bus at that point and repairs of dents, if any, would be greatly simplified.

Credits: Seats manufactured by American Seating Co., Grand Rapids, Mich., for General Motors GMC Truck and Coach Div.; matched-metal molding by Molded Fiber Glass Co., Ashtabula, Ohio; hand-layup by Roller Reinforced Plastics, Ashtabula, Ohio; polyester resin by Hooker Electrochemical Co., Niagara Falls, N. Y., The Glidden Co., Cleveland, Ohio, Bakelite Co., New York, N. Y., and H. H. Robertson Co., Pittsburgh, Pa.; glass mat and woven roving by Fiber Glass Industries, Amsterdam, N. Y.; pigments by Plastic Molders Supply Co., Fanwood, N. J.; melamine laminate panels by The Consoweld Corp., Wisconsin Rapids, Wis.

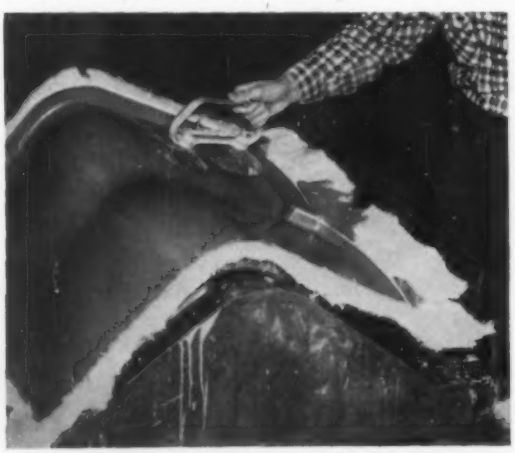
[1] For details on reinforced plastics molding techniques, see "Molding reinforced plastics," Modern Plastics Encyclopedia Issue, Sept. 1957, pp. 518-522.

Molding a reinforced plastics double seat

First step consists of placing tailored glass mat on male part of mold

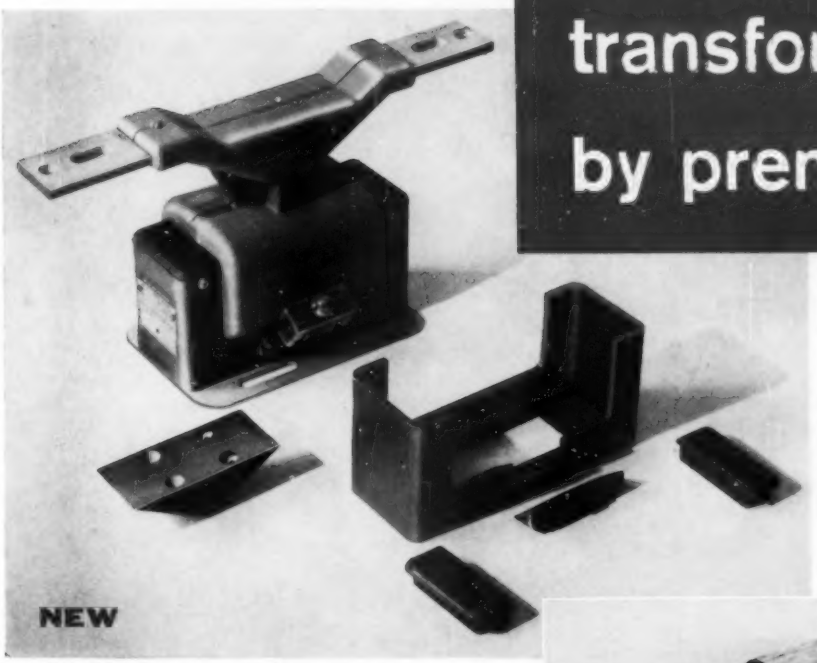
Next, polyester resin mix is poured over mat. (Photos, Molded Fiber Glass Co.)

At end of cycle, molded part is removed from mold by means of suction cups

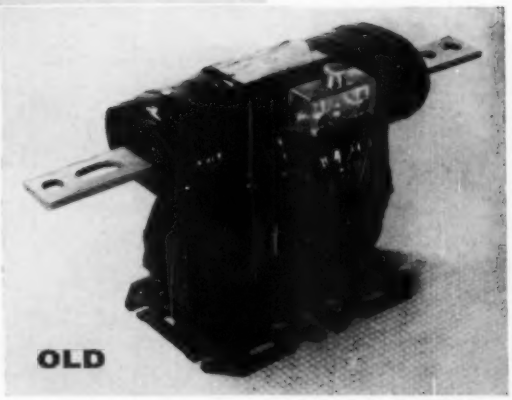


Edges are sanded to smooth rounded shape to eliminate possible sharp spots

Transformer transformed by premix



Redesigned transformer. Silicone-based insulating material is molded to coil assembly. In foreground are molded premix terminal block (left) and components of housing assembly. (Photo, Atlas Powder Co.)



Old-type transformer. Coils and terminals are hand-wound with insulating tape. (Photo, General Electric Co.)

To achieve higher rating factors with appreciable reductions in weight and lower manufacturing costs in high-voltage current transformers was the aim of design engineers of Westinghouse Electric Co.—and, of course, plastics entered the picture.

They accomplished these goals—and more. The new units are about 20% smaller than the transformers they replace, meet ASA and NEMA standards. Unaffected by moisture and temperature changes, they are more efficient.

In previous models, the coils and terminals were hand wound with small mountains of insulating tape in a tedious and expensive operation. The new models are insulated by silicone-base material molded to the coil assembly, completely sealing it from moisture and air.

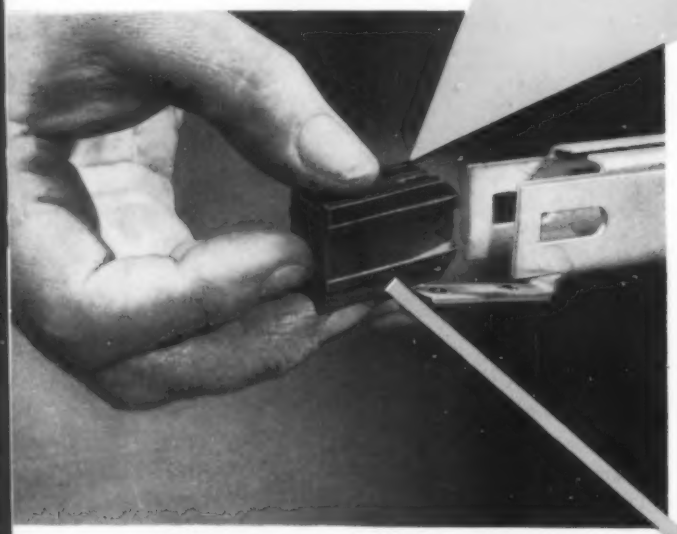
In the housing and connection assembly two different forms of Atlac Thermaflow polyester-glass premix material were used by the contracting molder, Carl Zehr Co., Ashtabula, Ohio. The terminals are screwed into a triangular block molded of Thermaflow 500, which is bolted inside the body of the transformer, eliminating the former brazing of terminals to the body. Westinghouse tests show that it took 940 lb. of pull to yank out a #10 screw embedded ½ in. in the block.

The housing components were molded of Thermaflow 2400 in four parts, eliminating several welding and strapping operations formerly necessary. Total result: a lightweight unit that can be easily mounted in any position on wall, ceiling, or floor, a cut in assembly time of over 30%, and a better, longer-lasting product.

Small part: big savings

New nylon compound lockstop for oven drop door replaces five pieces, saves over 10% in material cost, cuts per-unit labor expense

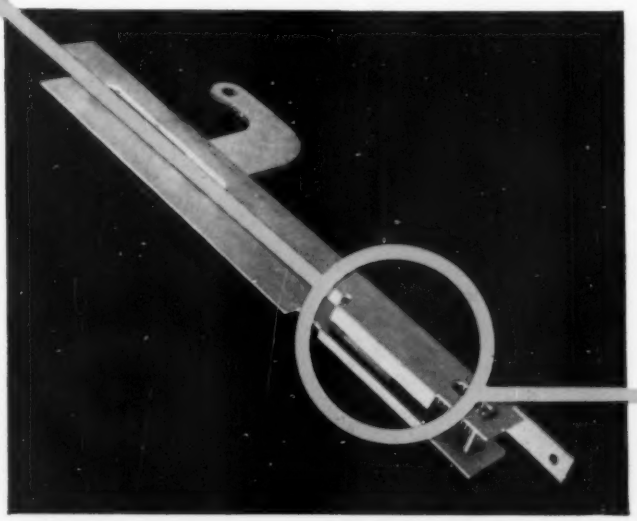
Close-up of nylon slide; note scale in foreground



Slide is inserted through top of metal guide arm

Few owners of 1958 Westinghouse electric ranges will ever be aware of the intricately-shaped small nylon part used as a slide in the lockstops of the oven door; yet this injection molded component, despite its size (just over 1¾ in. long, 1 in. wide, and ½ in. thick), plays an important role in the quiet, efficient, and trouble-free operation of the unit.

The lockstop does two things: 1) it prevents the oven door from opening beyond the horizontal and 2) it keeps the door slightly ajar when the oven is used for broiling. The func-



Spring-loaded nylon slide, in position in metal guide arm

tion of the slide is to guide a stamped metal arm within a metal body guide when the oven door is opened or closed, during which course it moves about ⅝ inch.

The use of nylon in lockstops on Westinghouse ranges dates back to 1953. At that time, and until the 1957 models, the lockstop was composed of five pieces: a nylon slotted pulley, a sintered metal bearing pin, a yoke, a guide pin, and a spring. This lockstop, however, occasionally caused screeching and binding if the hinge blade and body guide were more than ⅛ in. out of alignment. Because of this and other reasons it was decided to alter the design of the piece by changing the main body to molded nylon.

Three major requirements had to be met: the slide had to have high heat resistance, good abrasion resistance, and good dimensional stability. In addition, it had to be exceptionally rigid.

After investigating various formulations for the unit, Westinghouse engineers chose Nylatron-GS, a molybdenum disulfide-filled nylon molding compound. According to the material maker, MoS_2, a dry lubricant, adds greater rigidity and higher heat distortion temperature to the molded part without reducing the excellent low surface friction of the nylon. It also adds high wear and abrasion resistance and better tolerance control during the molding process.

Tests conducted by engineers of the end-user company confirmed these claims.

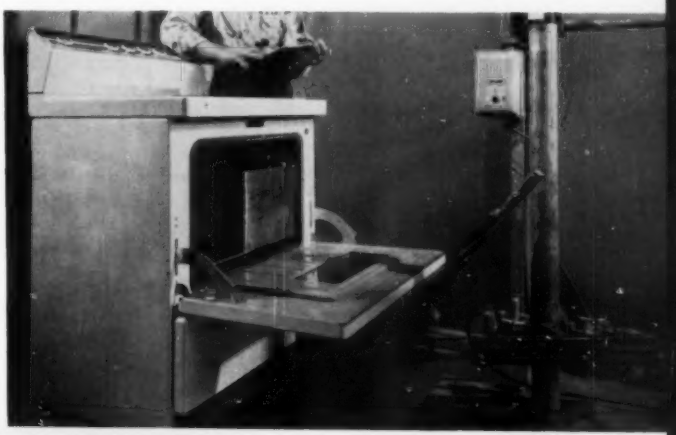
In a check for abrasion resistance, the new slides, after being subjected to the equivalent of 30 years' normal use, still retained about 50% of their wearing surface allowance of 0.125 in., according to the company.

In temperature tests, the slide material did not flow until nearly 400° F. was reached under a 13-lb. load with a point contact. Normal maximum temperature at the slide, with the oven door closed for 4 hr., is about 285° F.; springs in the lockstop generally exert a load of about 8 pounds.

Molding tolerances were set at plus 0.003 and minus 0.000 inch . . . and were achieved with a minimum of rejects.

Finally, by incorporating the molded nylon slide in its new lockstop design, Westinghouse was able to reduce material cost by 10 to 20% and also to affect substantial assembly time savings.

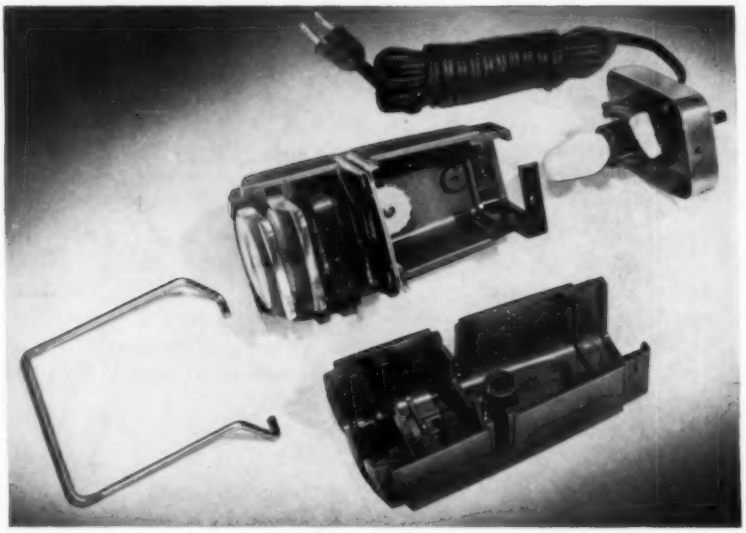
Credits: Nylatron-GS by National Polymer Products, Inc., Reading, Pa.; molding by Millington Mfg. Co., Upper Sandusky, Ohio.



Inside view of stove, showing location of slides and metal guide arms

Test set-up for checking abrasion resistance of slides. Rig at right opens and closes door automatically. Slides subjected to the equivalent of 30 years' opening and closing still retained about 50% of their wearing surface allowance. (Photos, National Polymer)

A STRONG CASE



Filmstrip viewer incorporates a number of plastics components. As shown in parts shot, right, these include (left to right) plastisol coating on wire-stand, molded ABS housing halves, molded phenolic socket and switch base, and nylon wire connector. (Photos, Reinecke)

Two new film viewers, made independently by different manufacturers and intended for different markets, have two features in common: they both depend on plastics for their rugged, compact housings that are easy to use and easy on the eyes; and they both depend on plastics for engineering the inside of these housings so that assembly of the units can be done quickly, easily, and efficiently. One of the products is a slide viewer (with accompanying file case) that uses high-impact styrene, acrylic, and polyethylene to advantage. The other is a filmstrip viewer based on ABS (acrylonitrile-butadiene-styrene) polymer blend, vinyl plastisol, nylon, and phenolic materials.

Styrene slide viewer

The slide viewer, produced for Optics Mfg. Corp., Philadelphia, Pa., is virtually all-plastics, including the lenses. These latter are injection molded of acrylic in a precise operation calling for separate enclosures and individual ventilating systems for each molding machine to prevent contamination. By properly designing the four-cavity mold which is used, the lenses are ready for installation as-molded and have more uniformity, greater clarity, and are produced at a faster rate than was previously possible with lenses hand ground of acrylic sheet.

The two halves which form the case of the viewer are molded of high-impact styrene in a two-cavity mold. Grooves for slides and the rear lens holder are molded directly into the case and the top half of the case is designed so that it telescopes into an offset flange in the bottom half for a tight fit. The rear lens holder, bezel, and contact holders are also molded of impact styrene in an eight-cavity family mold.

Portable slide files which accompany the viewer are molded of polyethylene in one piece, including case, lid, and an integral hinge that reportedly can take some 300,000 openings and closings before showing signs of wear. Metal snap fasteners and a polyethylene handle are assembled to the case after molding.

Filmstrip viewer

The case for the second viewer, which is a filmstrip type designed for the Society for Visual Education, Inc., Chicago, Ill., is injection molded in two halves of ABS resin. Both halves are identical so that the same single-cavity mold

FOR PLASTICS

Housings of two new film viewers are molded of high impact styrene and styrene copolymer; acrylic, vinyl, nylon, and phenolic are used in other parts

can be used for either. Because of the excellent thermal insulating properties of ABS, the case can be held in the viewer's hand without any discomfort from the heat of a 7-w. bulb mounted in the rear of the unit. For viewing from desk or table top, the case is supplied with a wire stand (which also doubles as a handle) dip coated at its lower end with vinyl plastisol.

Assembly of the viewer case is simplified by a molded-in tongue-and-groove construction on the mating edges of the case halves which permits an interlocking fit. Supports and bosses are also molded into the inside of the case to anchor the glass lenses, the metal assembly through which the film feeds, and the frames which join the halves together.

Other plastics components in the viewer include a molded phenolic socket and switch base and a molded nylon wire connector that eliminates the need for soldered contacts.

Credits: Slide viewer parts molded by Auburn Plastics, Inc., Auburn, N. Y., of Rohm & Haas acrylic resin and Koppers Co. high-impact styrene. Filmstrip viewer styled by Reinecke & Assoc., Chicago, Ill., and molded of Marbon Chemical's Cycolac ABS resin by Superior Plastics, Inc., Chicago, Ill.

Slide viewer (left) and slide file (right) are made almost exclusively of plastics: viewer housing, lens holder, and bezel are molded of impact styrene; lenses are injection molded of acrylic; slide file with intergral hinge is molded of polyethylene; polyethylene handle is attached to file after molding

Housing of Philco portable television set is made of vinyl-clad metal. (Photo, Poloron Products, Inc.)

Vinyl-metal laminates -

Vinyl-to-metal laminating has taken several giant steps in the four short years that it has been out of the laboratory. Fully described in the June 1955 issue of MODERN PLASTICS, the process was used to make about one million sq. ft. of laminate in that year; by 1957 the process had spread to Europe and consumption jumped to 18 million square feet. Conservative predictions are that usage will top 140 million sq. ft. by 1960.

In transportation and building

Deepest penetration of the transportation field by the laminate is in the 1958 Ford Thunderbird. The T-Bird has nine separate parts—including seat base panels and a decorative housing for the drive shaft—made from the laminate, which is also riding the roads in some 1958 Cadillacs, Chryslers, Pontiacs, and DeSotos.

The vinyl-metal material is used for seat backs on some long-distance buses, interior

*Technical Representative, Marvibond Process, Naugatuck Chemical, Naugatuck, Conn.

Interior trim of Boeing's 707 jet transport, made of same type of material, combines strength and beauty. (Photo, Clad-Rex Corp.)

Another application is this back of an experimental bus seat. Plastic is applied to metal before forming. (Photo, U. S. Rubber)

paneling on New York Central's "Train X," and the New Haven's new train, the "Daniel Webster." A group of railroad cars now under construction will be equipped with laminate interior paneling, and this will be its first large-scale use by railroads. It is also high in the clouds as interior trim on Boeing's new 707 jet transport. It will soon be on and under the sea as bulkheads for tankers and submarines.

A most spectacular recent use in building construction is in "curtain walls," wherein composite panels of insulated and surfaced materials are literally hung on a steel framework. In four new office buildings in Rochester, Minn., the panels were made with an exterior surface of porcelainized metal, an insulating core of asbestos, and an interior or room-wall surface of semi-rigid vinyl plastic laminated to metal.

The process

The laminating process was developed to give vinyl, probably the most versatile of plastics, still another use. Its uses already ranged from flooring to footwear, paint to pipe, and shower curtains to upholstery fabric. Sales have boomed in recent years but have failed to keep pace with the optimism of vinyl makers. New production facilities have gone up at a rapid clip, and one expert claims the industry can't hope to use all of its present capacity much before 1963.

Just who should be given credit for conceiving the process is vague. Apparently there were several concurrent developments. The first recorded use, however, was in 1954 when laminate made by Hood Rubber Co., a division of B. F. Goodrich Co., was formed into business machine housings.

Hood Rubber's laminate was made by a press process, a sheet at a time. In 1954 Naugatuck Chemical announced a high-speed process for making laminate on a continuous basis. C. E. Kiernan of Naugatuck's research department developed the process, and basic adhesive research was done by W. K. Fisher, also a Naugatuck researcher. Another early pioneer in laminating was the O'Sullivan Rubber Co.

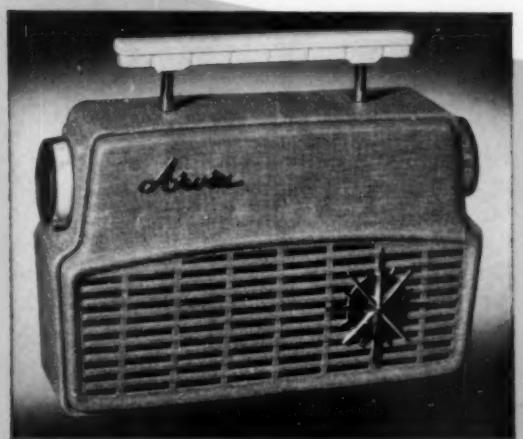
Know-how and equipment design are the

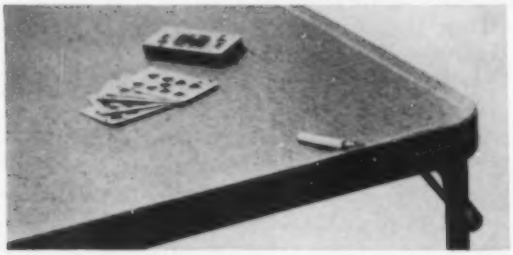
-up 1800% in two years

*By Vincent Bartelmo**

Medallion line of Samsonite two-tone luggage uses the material to stylistic advantage. (Photo, Shwayder Brothers)

Cabinets for portable radios constitute a promising market for vinyl-metal laminates. (Photo, Masland Duraleather)





Vinyl-metal tops of Samsonite folding tables are scratch-, burn-, and stain-resistant. (Photos, Columbus Coated Fabrics Corp.)

keys to the process, and Naugatuck spread this information under a licensing agreement for its Marvibond laminating method. Most major laminators in this country and in Europe operate under a Marvibond license. The exceptions are Hood Rubber, O'Sullivan, and John Sommers, Ltd., England.

The continuous laminating process was reasonably mature, from a technical standpoint, when it came onto the industrial scene. It could be built into production lines, and finished laminate could be shaped by almost any metal-forming technique. One limitation, however, was that it could not be welded, for the heat generated deformed the vinyl sheet. That shortcoming has now been eliminated.

Welding the laminates

Welding techniques, using high voltage and split-second welding cycles, have been developed in this country and in Europe. Arvin Industries, Inc., Columbus, Ind., pioneered the new welding method in this country. Working with Precision Welder & Flexopress Corp., Cincinnati, Ohio, Arvin came up with a machine to spot weld the laminate's metal in a millisecond. The machine's electronic controls, which make possible the precise and almost instantaneous weld cycle, were developed for Arvin by Robotron Corp., Detroit.

The largest foreign laminator, Phenix Works, S. A., Belgium, has developed another welding technique. Called Skinplate welding, it also uses high voltage to shorten the welding cycle for spot-welding.

Deep-draw problems

Another technical problem has recently cropped up. When laminates that have been deep drawn are exposed to heat in the 180° F. range for several hours, the adhesive used loses part of its strength, and some delamination results. Also, on very deep draws the vinyl sheet pulls away along the edge of the sheet being shaped, creating an effect called "ballerina" edge delamination.

Both problems are being worked on, and it is hoped that an improved adhesive will be the solution. Arvin Industries says it has already come up with a new adhesive technique and reports highly satisfactory laminates. John Sommers, Ltd., claims it has a trouble-free adhesive, and Naugatuck reports progress in laboratory trials of a new adhesive.

New applications

While laboratory development continues, new applications are still being found for the laminate. For example, General Electric, Motorola, Philco, Trav-Ler, Warwick, and Westinghouse are using vinyl-metal cabinets for portable TV sets. General Electric also uses the laminate inside the TV cabinet because vinyl has high dielectric strength and is an excellent insulator.

The laminate is also being used for radio cabinets, housings for hi-fi components, and the case for a portable record player.

Three luggage manufacturers—Shwayder

Bros., Poloron, and Platt—now have complete lines of laminate luggage on the market. Magnesium and aluminum are the base metals, making the luggage light and very tough.

In the furniture field the laminate is used by Shwayder for bridge tables, folding chairs, juvenile furniture, school furniture, and hostess tables. Hampden Specialty Products, Inc., Easthampton, Mass., is using it for outdoor furniture and folding chairs. Other furniture applications include office furniture, rugged desk tops, retail display racks, etc.

In the building field the laminate is finding many uses in addition to curtain walls. In Denver's Mile-High Center it is used for partitioning. In Chicago's Palmer House it protects walls in a service area. There have also been installations of the laminate as wainscoting in office buildings, schools, restaurants, hospitals, and homes. Institutional doors are also being made from laminate by Kawneer Co., Niles, Mich.

Other general uses for the laminate include gun cases, interior paneling for house trailers, deck covering for small boats, portable typewriter cases, housings for water coolers and air conditioners, TV serving trays and a new line of serving trays for home, restaurant, and school use just introduced by the Wearever Div. of Alcoa.

Overseas, Phenix is supplying laminate for wainscoting in office buildings, theaters, restaurants, and other public buildings; housings for oil burners, washing machines, electric dryers and refrigerators; kitchen cabinets; train interiors and shower stalls—among others. The firm is also using the laminate for chemical drums, roofing tiles, and building exteriors.

Some of the new applications being worked on in this country include laminating to galvanized steel with a special adhesive that prevents the zinc in the galvanized coating from migrating to the plastic. This process, developed by Naugatuck, could open up a whole new field for galvanized steel, which while extremely rugged, is difficult to keep painted. Considerable work has also been done by North East Laminates, Inc., Methuen, Mass., and Met-L-Wood Corp., Chicago, Ill., on laminating to non-metallic cores such as plywood and composition board for paneling in private homes. Johns-Manville and Wayne Mfg. Co. have laminated vinyl sheet to asbestos board for shipboard use.

The firms now laminating are mainly in or closely tied with the metal industry. Here are the laminators and the general areas in which they are working:

Clad Rex Corporation, a (*To page* 209)

Flush metal door is made by facing impregnated paper honeycomb with vinyl-aluminum. Cardboard under laminate acts as shock absorber

Assembled sandwich of flush door is placed into hot-platen press (at right) where it will be bonded into single unit. (Photos, U. S. Rubber Co.)

Operator threads gusseted polyethylene film through cutting-sealing bars of bagging machine preparatory to covering dry-cleaned suit

Five seconds later suit has been hung on support rod and film is being pulled over it. Lower roll on machine stand is for narrow garments

Dry cleaning: big new

For covering freshly dry-cleaned garments, polyethylene film bags seem to have everything. Their transparency permits the customer to inspect his clothing at the cleaner without removing the bag; their moistureproofness protects the garments in wet weather; being soft and flexible, they drape easily over the arm, and do not tend to wrinkle clothing; their tear strength is far superior to that of paper; and, finally, they can be re-used by the customer to protect clothing between wearings and on auto trips, and in many other ways.

The dry-cleaning market offers considerable potential for polyethylene film. Annual gross receipts for dry-cleaning establishments in the U.S. average around $900 million. On the basis of one bag per $1 of business, the total market is in the magnitude of 900 million bags, or 10.8 billion sq. ft. of film.

A vigorous assault on this market is being conducted by Clopay Corp., Cincinnati, Ohio. Clopay, in addition to supplying fabricated polyethylene bags to dry cleaners, also offers a special machine which, using gusseted film, bags a garment in only 15 seconds. Such a machine not only eliminates bag inventories but also saves film, since each bag is cut to fit the garment; ready-made bags have fixed lengths of 30, 36, and 54 inches. This saving makes polyethylene bagging competitive with brown-paper

Pulling lever activates hot knives that cut and seal film. For purposes of illustration, an excess of material has been drawn down in photo

Support rod is lowered by pressure on pedal and suit removed. Machine is ready for next job. Elapsed time: 15 seconds

market for film

coverings. In the Cincinnati area, for instance, the price of machine-made polyethylene bags averages 1.9¢, compared with 2¢ for brown paper. Fabricated polyethylene bags average 2.6¢ each, and white paper bags cost 3¢.

Clopay's machine, called the Poly-bag'r, is simple and efficient, weighs only 100 lb., and requires 3 sq. ft. of floor space. It is available in both single- and double-roll models. The two-roll machine makes bags of 20-in. width for blouses and trousers, and 25-in. width for suits.

The height of the machine is adjustable to suit the individual operator. A garment bag is produced by cutting and heat-sealing a length of flat, gusseted film tubing with a single squeeze of hot cutting knives. At the same time, the edge of film remaining in the machine is cut straight across to be ready for the next bagging job.

A special virtue of the Poly-bag'r, according to Clopay spokesmen, is its simplicity, which makes it easy to repair and maintain. The heating element, for instance, can be replaced for only $3.75. The company's Sanitex Sales Div. supplies the machine, together with four rolls of film on the initial order, to dry cleaners through a system of distributors. The 6-mil film, manufactured by Clopay, is made from resins supplied by Bakelite Co. and United States Industrial Chemicals Co.

RP mail box

Use of reinforced plastics in the construction of a mailbox results in an attractive container that will never rust or lose its color, and never requires painting. Named the Town and Country, the new mailbox, molded of polyester resin reinforced with fibrous glass, is produced in two color combinations: dark green and white with brass trim, or all black with brass.

The product is completely waterproof and its light weight makes permanent installation easy. Because the colors are an integral part of the resin, the new mailbox retains a fresh, new look through its long life. It has more than adequate strength for the job and measures a roomy 16½ by 4½ by 7½ inches—large enough to hold the thickest magazines and newspapers.

Credits: Manufactured by Plastic Products Corp., 24001 Aurora Rd., Bedford Heights, Ohio, of Plaskon polyester resin supplied by Barrett Div., Allied Chemical & Dye Corp.

PLASTICS

Butyrate nibs for artists' pens

Artists and draftsmen—amateur and professional—can have a wide array of pen points at their immediate command with the purchase of a set of interchangeable nibs manufactured of butyrate. The threaded nibs, each of which holds a steel point, screw readily into the pen holder supplied. Thus a point can be changed instantly with no jamming, tugging, or soiling of fingers.

The injection molded nibs are available in a great variety of bright, permanent colors, so that the artist can identify a specific color with the type of point he needs. The metal points are firmly anchored in the plastic and aligned with the center of the nib. According to the manufacturer, they do not loosen or become wobbly.

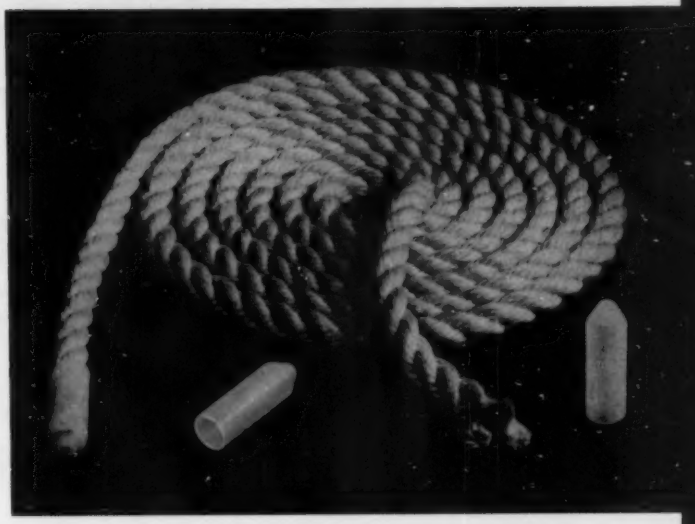
Credits: Artist's pen set manufactured by Di Carlo Pen Co., 3 Station Rd., Madison, N.J. Nibs and pen holders molded by Tech-Art Plastics Co., Ridgedale Ave., Morristown, N.J., of Tenite butyrate supplied by Eastman Chemical Products, Inc.

Polyethylene whip

The art of whipping line, practically unchanged since the days of Noah's Ark, has been brought up to date with the introduction of Polywhip, a polyethylene fitting that replaces traditional cord whip, and Polybond, a companion adhesive. The new technique requires no special tools, knowledge, or training. Simply coating the end of rope with adhesive and slipping on the fitting prevents the line from unlaying. The bond is unaffected by water and will withstand temperatures from 0 to 200° F. The polyethylene whip can be used on manila and polyethylene line.

Polywhips are injection molded in 12-cavity molds. They are available in sizes to fit ¼-, ½-, and ⅝-in. rope diameters and in four colors. Retail price is 99¢ for a box of 10, including adhesive.

Credits: Marketed by Contemporary Creations, P. O. Box 546, Palm Beach, Fla.; molding by The R & K Tool & Die Co., 3891 W. 150th St., Cleveland, Ohio, using Dow polyethylene.



PRODUCTS

Target set

Virtually all-plastics, a new toy shooting set consisting of three guns and a target makes use of four different plastics materials: cellulose acetate, cellulose acetate butyrate, styrene foam, and vinyl sheeting. The guns—a pump gun, a burp gun, and a pistol—all have extruded butyrate barrels, chosen for its dimensional stability. The stocks and handle grips of the guns are injection molded of acetate in multiple-cavity dies.

Balls of polystyrene foam serve as ammunition for the target set. These balls are molded from expandable polystyrene beads in a steam-heated multiple cavity die. The target of the set is fabricated of 0.004-gage vinyl sheeting. Heat-sealed pockets in the target trap the styrene balls.

Credits: Manufactured by Ack-Ack, Inc., 18101 E. Ten Mile Rd., E. Detroit, Mich. Butyrate supplied by Eastman Chemical Co., acetate by Celanese Corp. of America, and styrene foam beads by Koppers Co.

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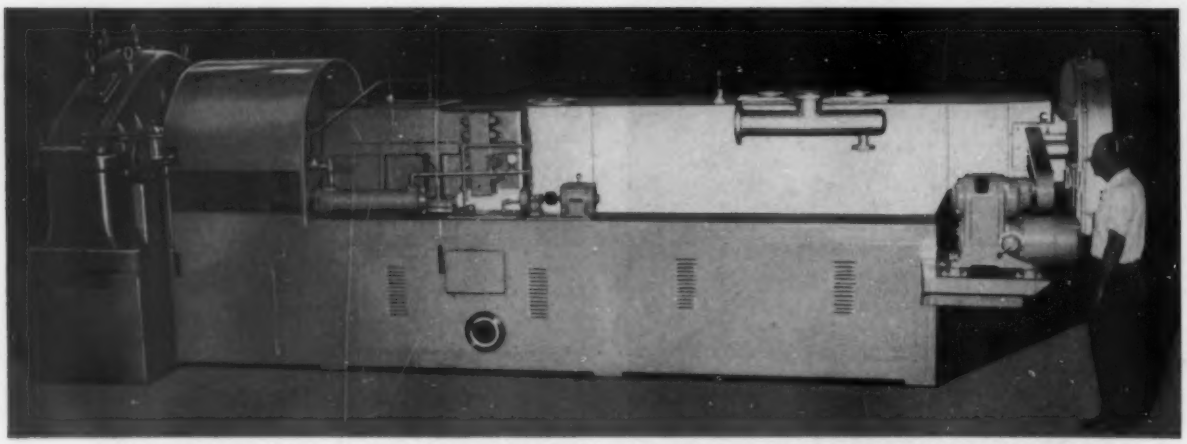

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Dr. James F. Carley, Engineering Editor

Effective mold design

The intricacies of some products severely test the mold designer's ingenuity; successful solutions to two such problems are described with the aid of detailed drawings

By Curtis F. Pearl†

Every plastics molder knows how good mold design can affect the economic success of the molding operation. A properly designed mold will make it possible to produce a molded item within its dimensional tolerances, without strained areas, and at a cycle that is in a commercially competitive range.

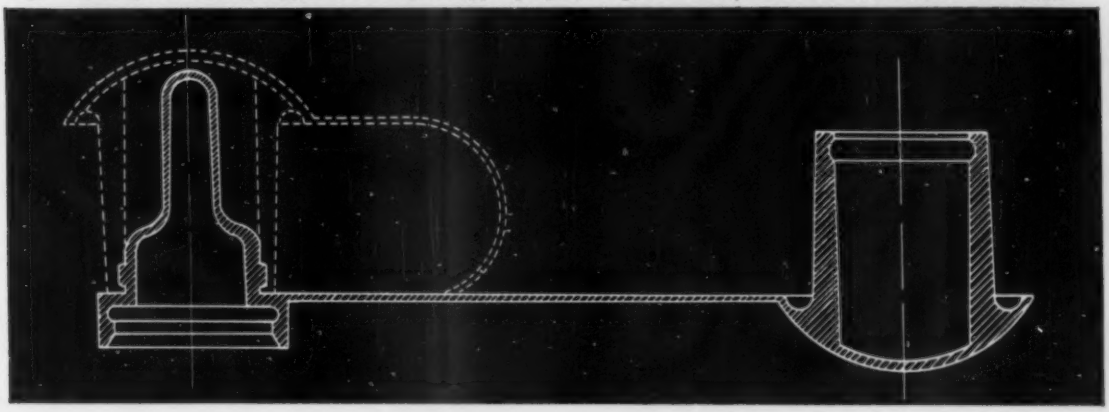
New materials which are constantly being presented to the molder often require new techniques that may entail special mold construction. Some, because of their unique combinations of properties, offer special opportunity for the exercise of ingenuity in mold design, and, therefore, in product design. While some general rules and recommendations for mold design have been offered, the special jobs require special consideration. Two such jobs, and the molds designed to produce them, are presented in the hope that the ideas developed here may be useful to others having similar problems. The drawings have purposely been simplified to eliminate details that do not pertain to the actual functioning of this mold.

The first of these products was a nursing nipple shown in Fig. 1, below. This consisted of a nipple and a "captive" cap, the two being connected by a strap, the entire assembly to be one piece. To make the cap proof against leaking, sealing beads were designed into both pieces. In the mold as originally designed, the seriousness of the undercuts created by these beads and by the bottle-rim ring was underestimated, and the nipple and cap had a tendency to stick in opposite faces of the mold, with resulting tearing of the strap. Several other mold designs were discarded before the final version was adopted, and this was tested

*Reg. U. S. Pat. Off.

†Arnkurt Associate Engineers, 31 East 27th St., New York 16, N.Y.

Fig. 1: One-piece nursing nipple, consisting of nipple proper, strap, and cover, has several troublesome undercuts



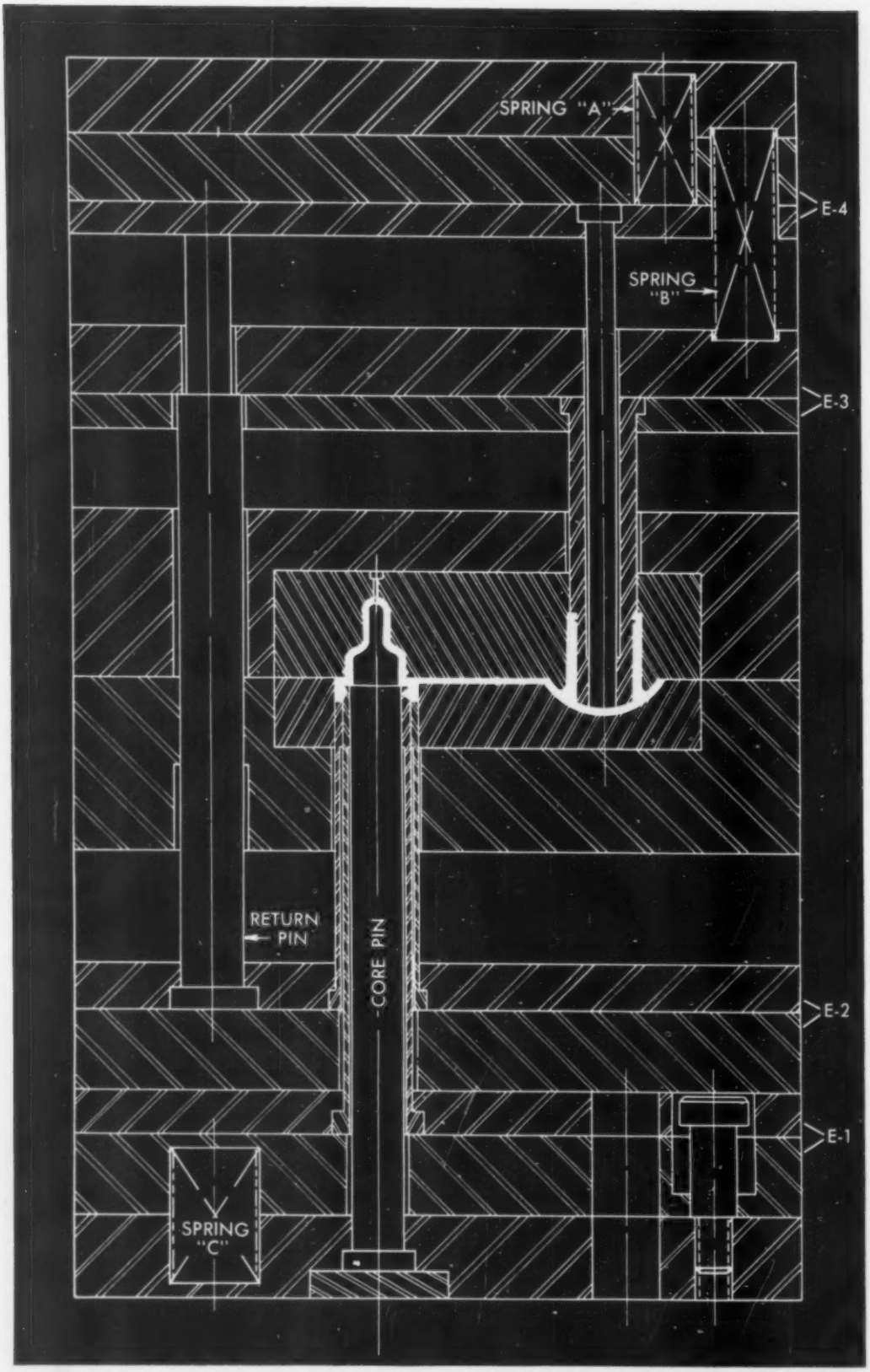


Fig. 2: Twelve-plate mold for nursing nipple, shown just after the shot has been made. Springs, distributed fairly uniformly throughout mold area, are represented here by single units to minimize unnecessary detail

first in a two-cavity injection mold.

The final mold design is shown in the mold-closed position in Fig. 2, p. 112 (only one cavity-pair is shown here, for simplicity). There is a double ejection mechanism on both sides of this mold; this guarantees a sequence of release that, though it still relies on the springiness of newly molded polyethylene, puts no stress on the connecting strap. The double knockout mechanism, consisting of plates E-1 and E-2 on the moving side, are actuated by the knockout bar of the molding machine and by high-force springs, while the double knock-out mechanism on the stationary side, consisting of plates E-3 and E-4, is actuated only by springs. This mold is unusually thick, so an extended nozzle was used to reduce length of sprue bushing.

How it works

As the molding machine opens, the spring-loaded knock-out plate (E-1) on the moving side of the mold moves forward, due to the force exerted by high-pressure springs (C). This assures that the nipple proper remains on the stationary side of the mold by virtue of the stripper and core sleeves. Simultaneously, the core-pin forming the interior of the nipple withdraws, freeing the nipple inside. The molded cap remains in the cavity, since the double knock-out plates (E-3 and E-4) in the stationary side of the mold remain in their original position, due to the action of the stepped-diameter return pin. The double knock-out plates (E-1 and E-2) in the moving half of the mold will move upward together for a sufficient distance, to assure that the nipple is completely free from any core-pin interference. Then the lower knock-out plate (E-1) is stopped in its movement by the limiting length of the stripper bolts. At this point, the stepped-diameter return-pin will start to withdraw out of the stationary half of the mold. When this occurs, the double knock-out plates (E-3 and E-4) in the stationary half of the mold, will start to move downward as one unit, because of the pressure that is exerted by springs (a and b) in Fig. 3, right.

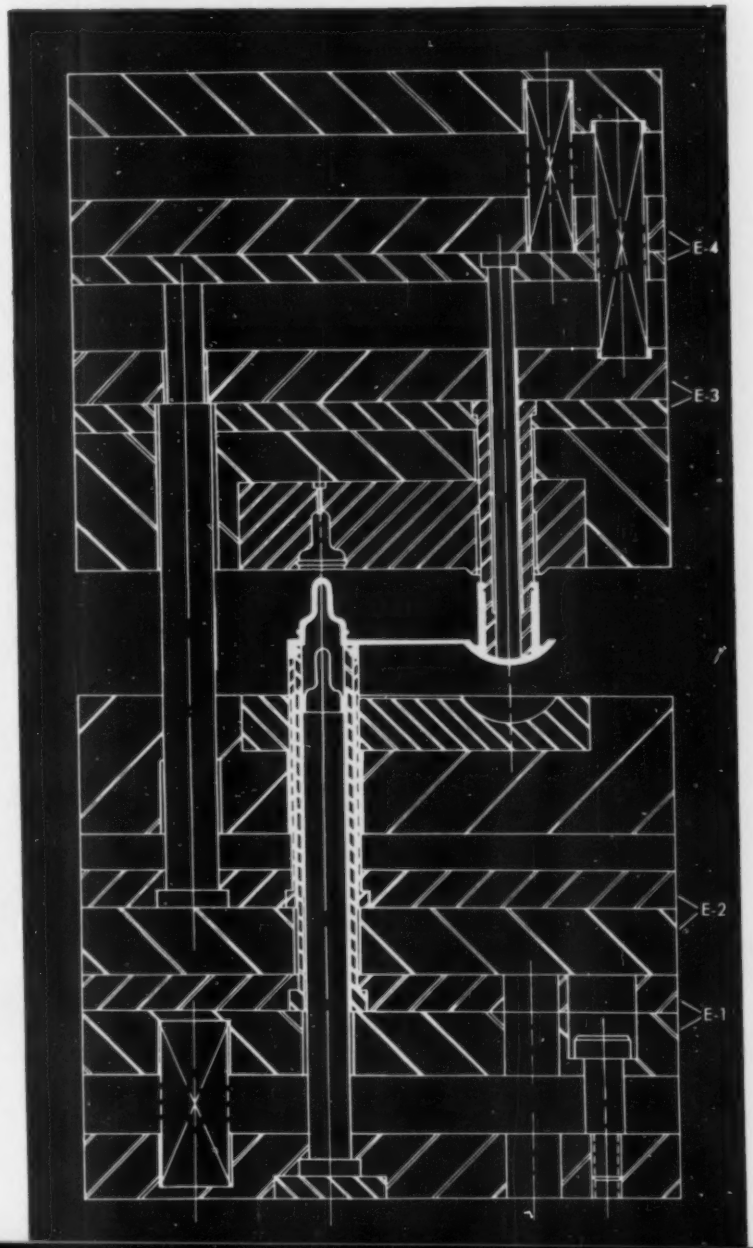
As the mold continues to open, the nipple is still held in place on the core sleeve. At the same time, the cap is being ejected from the cavity. As knock-out plate (E-3) reaches the end of its travel, the molded cap is completely freed from the cavity; this is the situation in Fig. 3, below. The cap is subsequently stripped by the action of knock-out plate (E-4), which is the secondary knock-out plate on the stationary side of the mold.

Plate E-4 continues to move downward and in doing so, strips the cap from its core sleeve and leaves it suspended by the strap. The mold continues to open until the knock-out bar of the molding machine makes contact with the knock-out plate (E-2), causing it to move and strip the nipple from the undercut core sleeve, allowing the entire molded unit to fall free of the mold, as shown in Fig. 4, p. 114.

Bumper guard mold

The second of these molds was designed to make a vinyl bumper guard for a floor waxing machine;

Fig. 3: Nipple mold in partly open position, with nipple freed from its core and cap ejected from upper half of mold



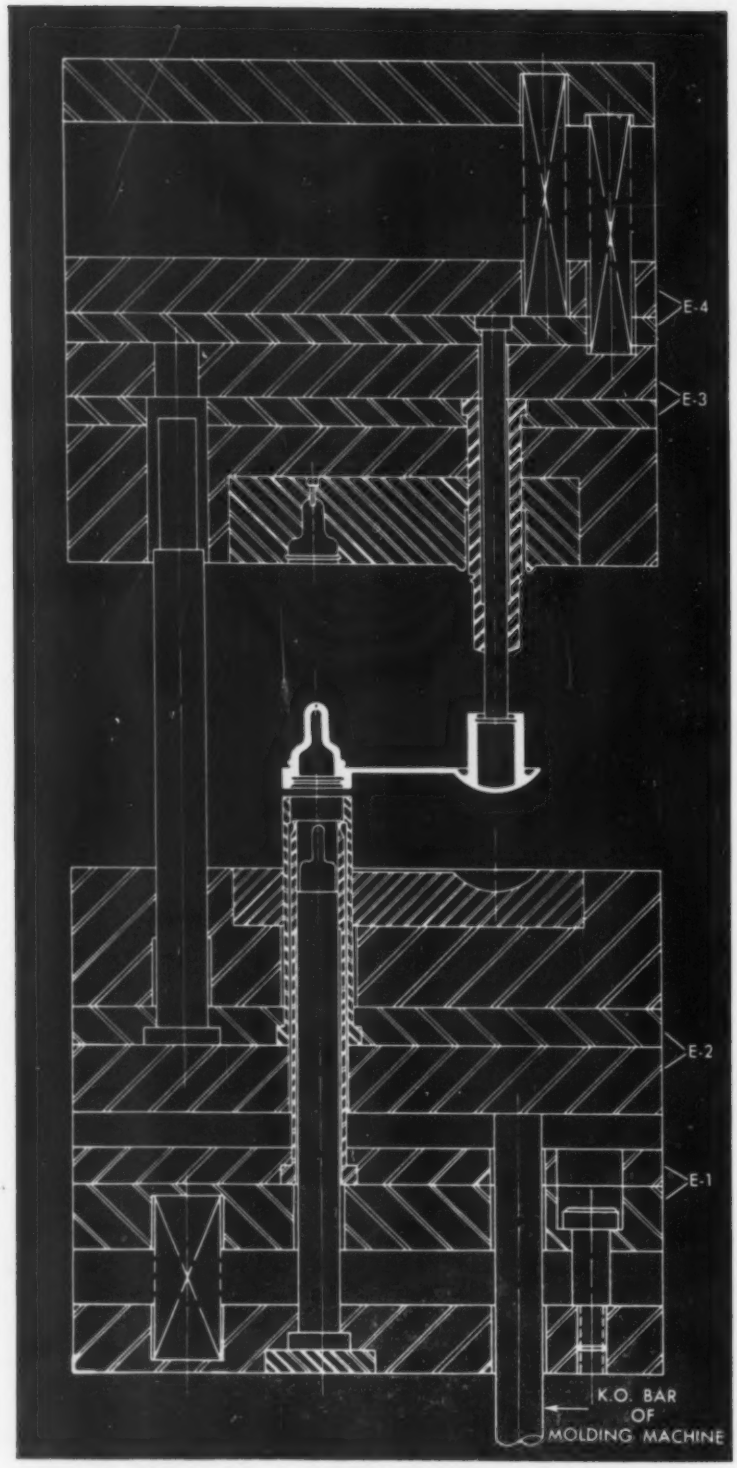


Fig. 4: Nipple mold in fully open position, with finished nipple stripped from undercut cores, ready to drop into hopper. Connecting strip cannot tear, since it is never stressed

this bumper guard was designed with a rim that was supposed to slip over the edge of the machine housing. This rim created an undercut in the mold. Another undercut was created by an area designed to receive the name plate of the waxing machine maker. The difficulties of these undercuts were overcome by incorporating a cam action into the mold. The rim construction made it necessary to build a mold with a floating core; this was split into two sections that progressively release the rim as they withdraw. The bumper is shown in the mold, in the mold-closed position, in Fig. 5, p. 115.

As the mold opens, the cam-slide (A) moves vertically upward, guided by the cam pin (B). This clears the undercut at the name-plate niche in the bumper guard (at upper end of slide A). At the same time, the left core (C), located in the injection side of the mold, moves down because of pressure exerted by the springs (D). This action extracts the guard from the injection half of the mold. When the stripper bolts (E), holding the left core, reach the end of their travel, the core stops moving and the upper part of the molded bumper guard is fully exposed. As the mold continues to open, the guard is stripped off the left core by the holding action of the still-stationary core (F) on the ejection side of the mold. The knock-out bar of the molding machine finally forces the right core to the left, thus moving the molded piece out of its right cavity (G). Sprue and runners are stripped from the undercut sprue-puller-pin at this time. The right core is slid to the left of its cavity; the operator can then slide the guard off this core piece by hand. As the mold closes, cores and cam slide return to their original positions and a new injection cycle begins.

Acknowledgments

In designing such molds, it is important to work closely with the mold maker and the molder. The author wishes to acknowledge the wholehearted cooperation of Columbia Engineering Co. and Hungerford Plastics Corp. in the production of the second mold described above.

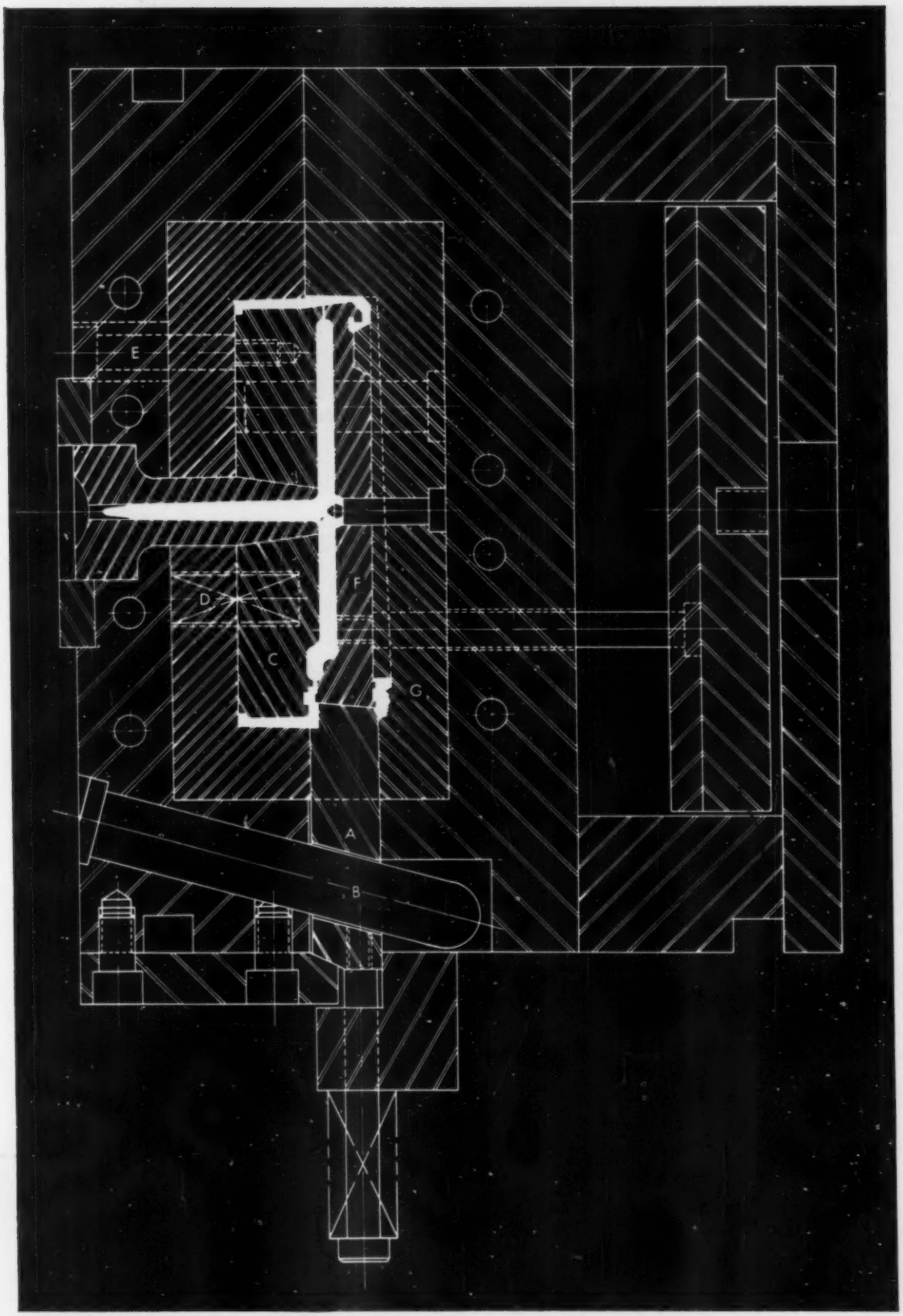


Fig. 5: Double-floating core mold for vinyl bumper guard of floor polisher. Note undercuts on both upper and lower halves of this intricate piece

Fig. 1: Folding doors made from vinyl-coated fabric. Installed from wall to wall, such doors can be used effectively as room dividers

Coating–printing–embossing

Coordinated equipment set up in one work area

produces vinyl coated fabric with any desired surface finish

A new production line for plastic-coating fabrics and applying embossed or printed designs to the coating can achieve a wide variety of effects on webs up to 64 in. wide at rates as high as 150 lineal ft./min. The line is used in making the material for folding vinyl doors[1] and partitions. (Fig. 1, above).

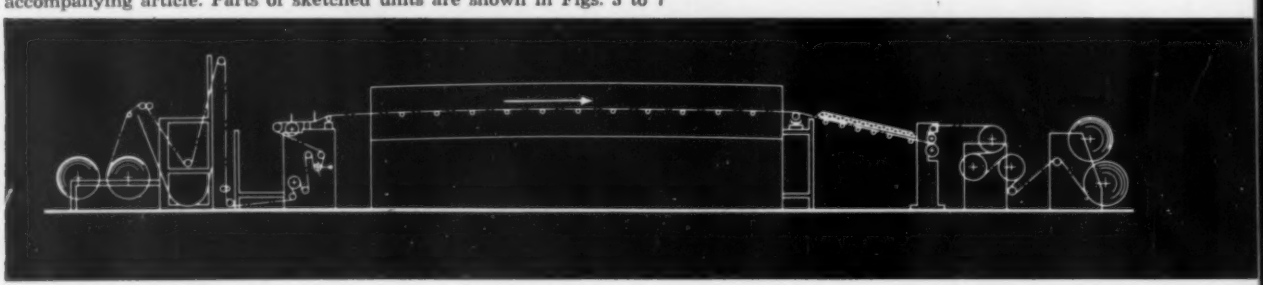
The system comprises three major elements—a base-coat line with in-tandem embosser; a finish-coat line which gravure-prints as well as coats; and an independent embosser. Schematic diagrams of these three elements are shown in Fig. 2. The base-coat line applies coatings of polyvinyl chloride plastisol or organosol to such fabrics as bark cloth, drills, sheeting, sateens, etc., and also dries and fuses these coatings in a 90-ft. zoned oven. The in-tandem embosser operates as a smoothing calender when embossing is not required.

The finish coating—polyvinyl chloride in solution—provides a heavier-weight, superior-quality finish having a more leather-like feeling and presenting a smoother surface for printing. Following finish-coating and/or printing, the product may be embossed in the independent embosser if desired.

All these treatments are applied

[1] "Modernfold" doors, produced by New Castle Products, Inc., New Castle, Ind.

Fig. 2: Three drawings—below, right, and above at right—show flow-through of material in the major elements of coated-fabric production plant described in accompanying article. Parts of sketched units are shown in Figs. 3 to 7



in the same work area, making possible close supervision and quality control as well as reducing movement of goods-in-process from one location to another. This versatile production line was cooperatively engineered by John Waldron Corp., New Brunswick, N. J., who built the web-handling, plastic-coating, gravure-printing, and embossing equipment, and J. O. Ross Engineering Corp., New York, N. Y., oven makers.

Base-coat line

The base-coat line begins with an unwind stand (Fig. 3, right) which accommodates one stand-by roll in addition to the roll being fed. The stand has an adjustable friction-band which fits around a drum on the feed-roll center-shaft to maintain web tension as the roll unwinds.

From the unwind stand the web travels first through driven unwind rolls, thence through a series of tension and guide rolls to the coating machine, into the oven, between guide rolls, through a radiant heater and embosser, and finally to water-cooled pull rolls and to a rewind roll. Motors for pull rolls, rewind rolls, and coater are synchronized so that one control regulates all three simultaneously, with proper draw-control (speed differential) between each. This synchronized control maintains constant web tension which not only aids in proper coating but also avoids flattening or stretching of the grain and eliminates future shrinkage of the vinyl in service.

Unwind rolls are driven by an independent motor and when a new roll of cloth is to be installed, the unwind motor is speeded up, pulling the remaining cloth from the near-empty roll. Since the other motors pull the cloth at a constant rate, this excess accumulates in a "J-box," from which the coating operation is fed while the old web is spliced to the new roll.

The ends of the old and new rolls are sewn together by a "railroad type" sewing machine which travels across the web, and sews a butt splice. Since the web is not overlapped at the splice, the fabric is processed without loss of material or mechanical difficulties.

Vinyl is applied to the fabric at the oven entrance by knife-coating, considered by the machine designers to be the most versatile method for general use. The vinyl, metered to the web, flows to each end of the knife and maintains a backlog of material at the edge of the blade. Factors which can be varied to control the thickness of coat on the web include speed of travel, type of knife, angle of knife adjustment, resin consistency, and web tension.

The oven has three temperature zones, each accounting for ap-

(*To page* 120)

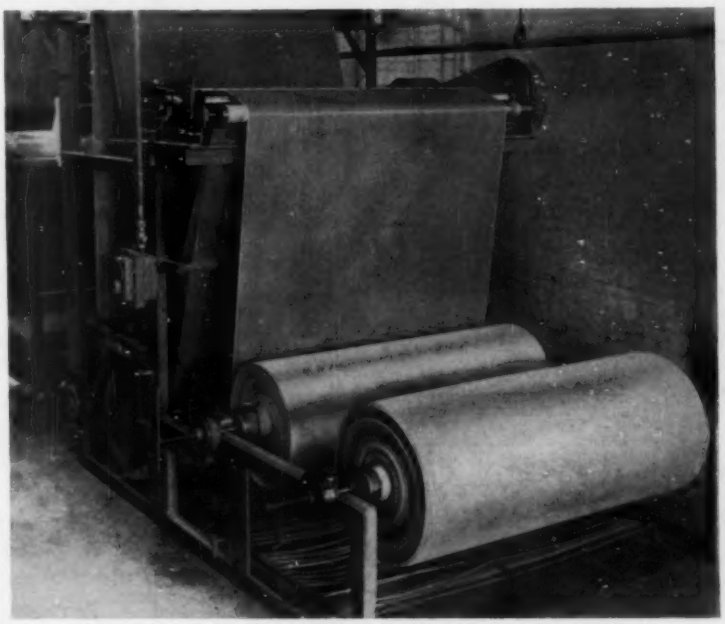


Fig. 3: Starting end of base-coat portion of line, with stand-by roll in position on unwind stand (foreground)

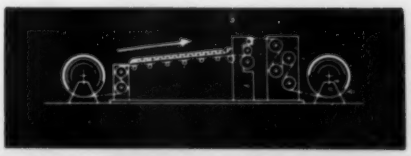
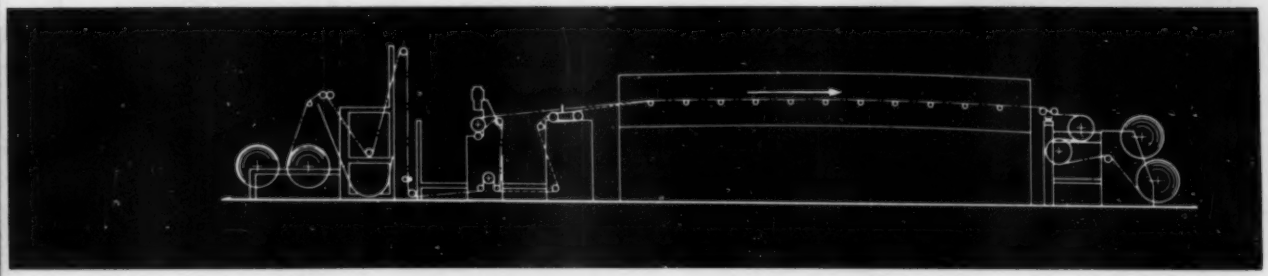


Fig. 2, cont'd: On opposite page, bottom, is schematic of base-coat line. Below is the finish-coating line, with printing set-up. The independent embosser is sketched at right



Molding attendant Norman Hubert examines a part that has just been made by one of the presses. In this section, two banks of presses—back-to-back—beat a steady production tempo of electrical insulator parts.

Bryant Electric's Plastics Department buys additional Stokes Model 741's for high-speed automatic molding

Fully automatic compression molding, on Stokes Model 741 presses, produces a wide variety of insulating parts for appliances, wiring devices and switch gear for this Connecticut manufacturer.

The Bryant Electric Company, Plastics Department, a subsidiary of Westinghouse Electric Corp., is thoroughly convinced of the excellence of Stokes automatic molding equipment. Twenty Model 741 50-ton presses have been in constant use, with another six just installed. Molded insulating parts for electrical appliances, lighting fixtures, switch gear, wiring devices, and the like, are being produced at high rates of speed—with dependable precision.

The fully automatic operation of the 741's requires minimum monitoring—there is not much that the attendant does other than remove the bins when they are full, occasionally check on parts as they are dumped into the bins, and load the hoppers with the molding compound.

The Plastics Department of Bryant selected Stokes equipment for its high standards of workmanship and excellence of service. Fully automatic production of these parts resulted in lower manufacturing costs and enabled them to meet competition more favorably.

For your own molding operations, it will pay you to check the advanced features of the new Stokes 741's that bring you fully automatic compression molding in its most fool-proof, most productive form.

25 years of leadership in automatic molding is built into these presses:

Parts can't fall back into molds . . . due to metal-to-metal contact between feed and comb, and scrape-off discharge independent of gravity.

Simplified set-up . . . feed changeovers made in five minutes. Pre-set loading board provides custom-adjusted feed for each job as part of the tooling.

Fast cycle, high output . . . average dry cycle time only 8 seconds.

Space-saving . . . in-line press design cuts floor area requirements, lets you line up feed and discharge in convenient rows.

Tops in versatility . . . positive top or bottom ejection available to suit the job . . . side-draw split cavity molds . . . automatic preheated powder feed . . . automatic feed of rope pre-mix.

Press capacities of 50, 75, 125, and 200 tons are available. Write today for a copy of our new bulletin on the Model 741, for a consultation on your requirements, and for a cost study on your specific applications.

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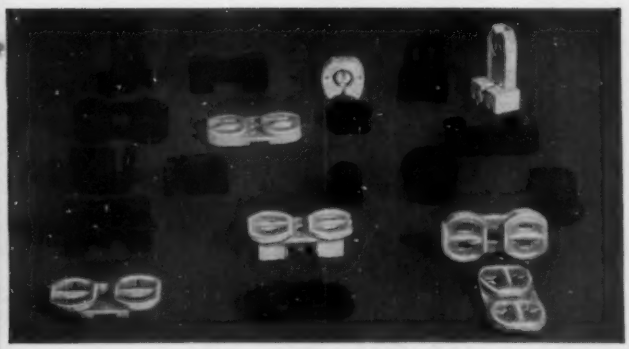


Above are some of the many parts produced at the Plastics Department of Bryant Electric including duplex outlets, switch blocks, and fluorescent lamp holders. At left, a partial view of the bank of Stokes 741 presses installed at Bryant Electric's Plastics Department.

STOKES

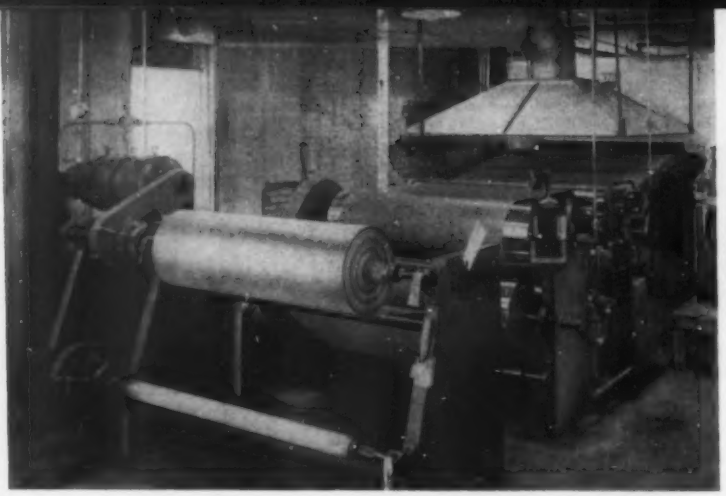


Fig. 4: Discharge end of base-coat line, showing (back to front) radiant heaters (beneath hood), embosser, pull rolls, and rewind. (Illustrations, John Waldron Corp.)

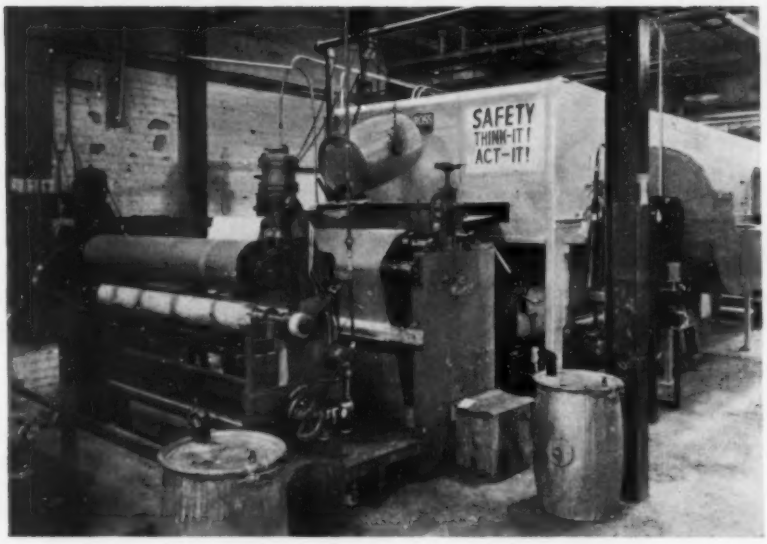


Fig. 5: Gravure printing unit (rolls covered) and coater at finish-coat line. Coater handwheels regulate angle of knife and pressure on web

proximately one-third of the oven. All zones may be operated at temperatures to 425° F., although generally the temperatures are staggered to bring the coating to fusing temperature in stages. Also, organosol solvents are removed in the initial lower-temperature zone. The high-temperature zone is, of course, where the fusing of the resins takes place, forming the homogeneous plastic film.

The oven is a one-pass, direct-heating, arch-type dryer, the arch holding the web flat and preventing wrinkles as it travels on idler rollers through the oven. High-velocity, high-impingement circulation characteristics provide the drying and fume removal capacities required for safe, high-speed fusing of vinyl coatings.

From the oven, the web passes between guide rolls and through the radiant heater and embosser where it may be heated and embossed or may simply pass through to pull and rewind rolls (Fig. 4, above).

Should embossing be called for, the coating is brought to 300 to 325° F., depending upon the job requirements, by the radiant heater operating at temperatures to 1400° F. This infra-red heating section has three zones, each of 18 kw., making it possible to bring the coating to temperature in stages. An exhaust system removes any fumes which may be given off at the heater.

Embossing takes place immediately after heating and any one of hundreds of designs can be produced by a water-cooled engraved-steel pattern roll which rotates against a neoprene pressure roll. The hardness of the rubber used is determined by the embossing detail required. Immediate water cooling of the rollers "freezes" or sets the pattern.

After leaving the embosser, the cloth travels around chrome-plated pull rolls and is rewound. Chrome plating the rolls gives the coating a smooth, even surface for additional coating or printing, and facilitates release.

The rewind stand has two shafts driven by independent motors. When a complete roll has been wound, the web is cut at the butt joint made previously and started on the second shaft. The completed roll is removed and an empty shaft installed for the next changeover. The roll may be finished here or go to the finish-coat line for further treatment.

Finish coating

At the finish-coat line, the head end is similar to that of the base-coat line but the web may travel

through a gravure printing unit and into the oven or may by-pass the gravure unit and receive a second coat and then pass through the oven.

The gravure unit (Fig. 5, p. 120) has a tapered mandrel over which is slid an engraved copper shell. The lower portion of the mandrel revolves in an ink fountain, the shell picking up ink in the engraved recesses. A doctor blade removes excess ink before the web passes between the engraved shell and a back-up roll for printing.

The oven that dries the finish coating and gravure inks is a single zone unit approximately 25 ft. long operating at temperatures to 250° F. The tail end of the finish-coat line has guide rolls, water-cooled pull-rolls, and two-shaft rewind stand as does the base-coat line.

The independent radiant heater and embosser unit (Figs. 6 and 7, below) operates similarly to the base-coat line embosser with the exception that it has its own unroll stand and is also equipped with steam-heated feed rolls which pre-heat the web prior to passing under the radiant heaters. These rolls are not required on the base-coat line embosser since the web enters the embosser directly from the oven.

Formulations used

Although there is a virtually endless variety of polyvinyl chloride formulations which may be used for coating fabrics, the following are "typical" plastisol, organosol, and solution formulations.

Plastisol: 100 parts by weight of PVC dispersion resin; 85 parts plasticizer; 20 parts filler, 2 to 5 parts pigment; and about 3 parts stabilizer.

Organosol: Same as plastisol, but thinned by an equal weight of solvent made up of aliphatic hydrocarbon thinner, with "active" or "primary" PVC solvents to swell the resin particles.

Solution: 12 parts vinyl copolymer resin; 4 to 4.5 parts plasticizer; 7 parts pigment, and about 77 parts of thinner, such as methyl isobutyl ketone with toluene, using either equal parts or a 70:30 ratio.

The installation just described is reported to be the largest single-purpose vinyl fabric-coating line in existence. It is designed for full-scale operation by six men and its versatility, high-volume output, and quality product undoubtedly will make it the model for future installations of its type.

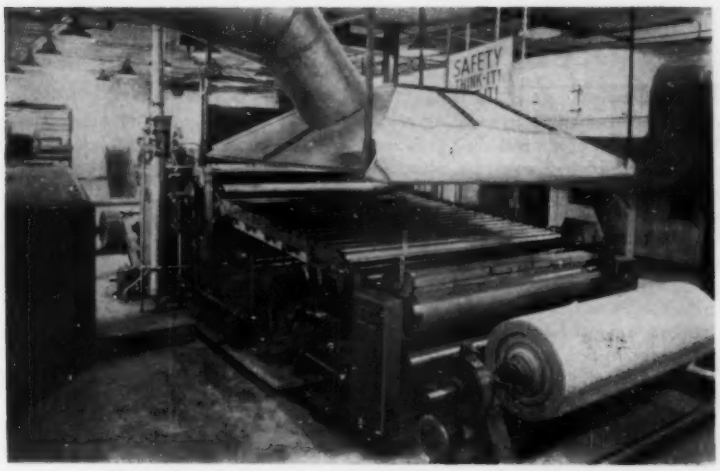


Fig. 6: Starting end of independent embossing unit shown schematically in the small drawing on p. 117. The web, coming from the roll on the unwind stand in right foreground of photo, travels around steam-heated rolls and beneath radiant heaters (center), which bring it up to the correct temperature for embossing. See Fig. 7, below

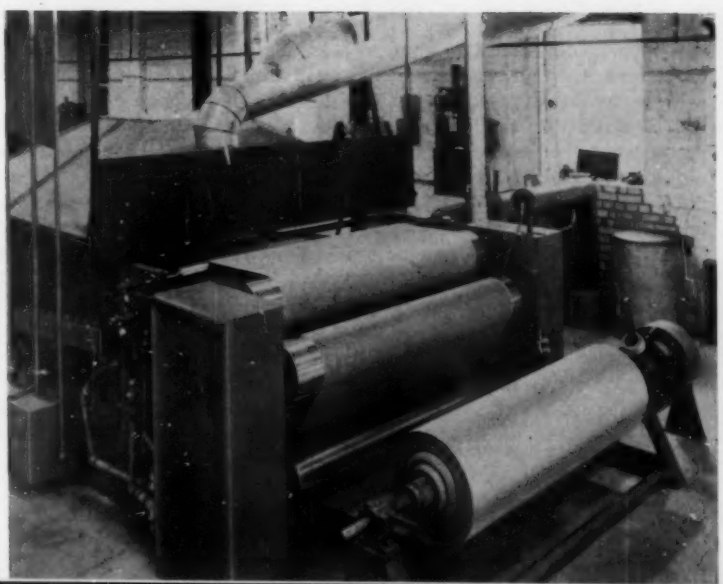


Fig. 7: Rewind end of embossing unit, starting end of which is shown in Fig. 6, above. The radiant heater is at left in the photo. After heating, the web travels between engraved-steel embossing and pressure rolls, around water-cooled pull rolls, and then is rewound (right foreground)

Fig. 1: Wastebasket molded of linear polyethylene. Gate is located at center of bottom

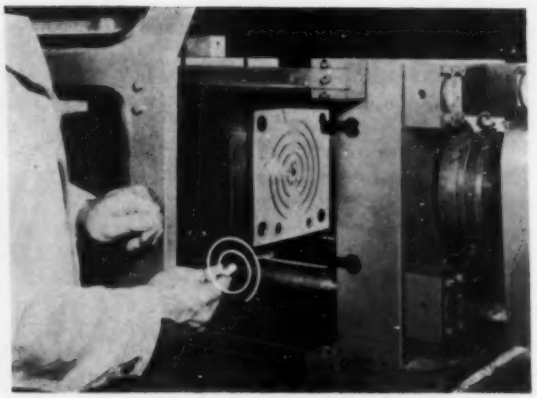


Fig. 2: Three-ounce injection machine in open position, showing mold and spiral molding

Molding linear polyethylene

By Albert Spaak and Clifford L. Weir**

The effects on distance of flow into a spiral mold of changes in molding conditions were measured for linear polyethylenes (PE) of several melt indexes and compared with results for branched PE and high-impact polystyrene. They show that the linear polymer is more reluctant to flow than the others, and its flow is less sensitive to changes in ram pressure and melt temperature than is the flow of branched PE. Mold cavities can be pin-point-gated if cold flow front in runner is diverted from gate entrance to a dead ring surrounding the gate. Recommended for best results: differential cooling of mold cavity areas to get uniform cooling times; generous sprues, runners, and gates; high filling rates (preplasticator helps); and melt temperatures between 375 and 550° F. Higher temperature degraded the polymer in this study: however, the residence time was unusually long here because the shot size was very small. Mold temperature should be the highest that will be consistent with an economical production cycle time.

Linear (high-density) polyethylene has a high viscosity over a wide temperature range; this has required the development of modifications of standard techniques of molding. In particular, it differs from polystyrene in several important molding properties. It has a higher, sharper melting point, a thermal conductivity approximately three times that of normal polystyrene, and a heat capacity about 1.5 times that of polystyrene.(1)[1] With this in mind, it must be considered that, as this material enters the injection mold, it cools very rapidly because of its good surface conductivity and retains its heat in the center of thick sections for a long period of time because of the high heat capacity of the materials.

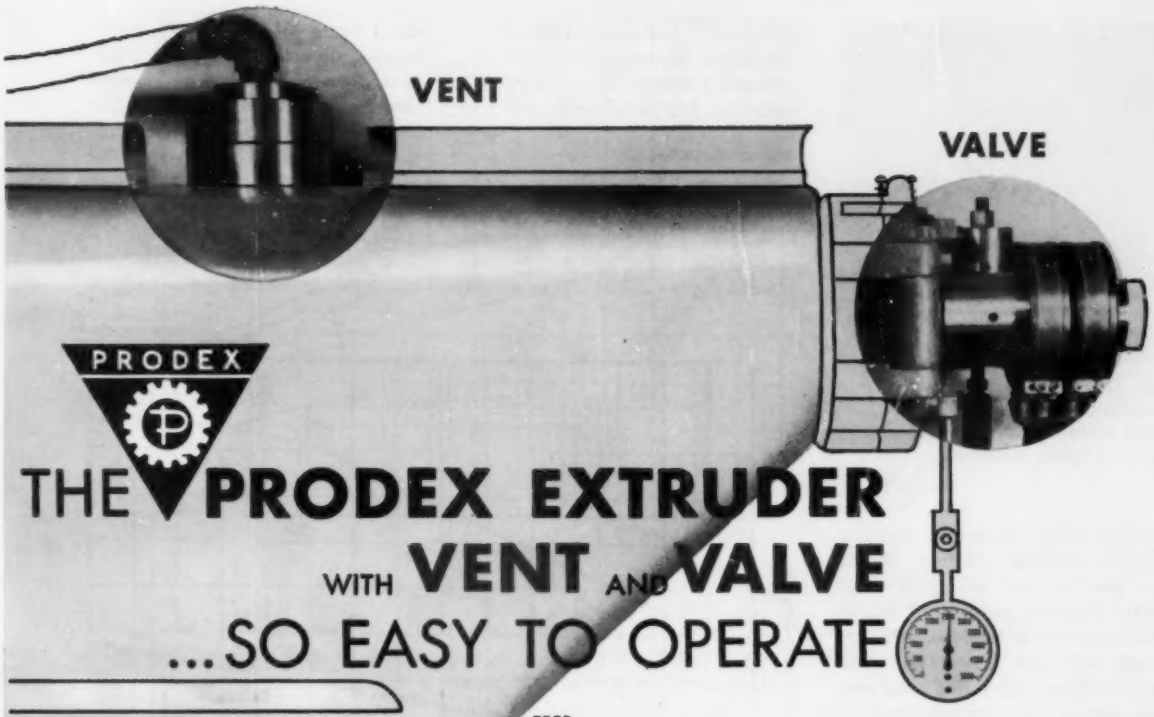
Very rapid injection speeds at high pressures are required to mold thin sections. This is rather evident in molding deep-draw articles with relatively thin cross sections, such as wastebaskets, garbage cans, etc. The actual filling time of the mold and traveling distance of the material in many cases can be too long, causing many difficulties in properly filling the mold. In the case of very thin-section container work, rapid injection speeds and high pressure are required to produce economical moldings.

In order to obtain a quality product at an economical cycle rate, all the factors influencing quality and output should be followed. Part designer, mold maker, material supplier, and molder must cooperate closely to insure a satisfactory solution to problems of flow, shrinkage tolerances, surface appearance, part removal, and physical properties. In molding larger items and thinner sections, the problem of getting the needed flow without sacrificing the mechanical properties and surface quality becomes more and more severe.

In order to prevent warpage, uniform rates of cooling must be maintained throughout all sections of the mold. Because of rapid crystallization on the surface of the material it stands to reason that the cavity surface should be hottest at the point

[1]Numbers in parentheses link with references listed at the end of this article.

*Polymer Chemicals Div., W. R. Grace Co., New York, N. Y.



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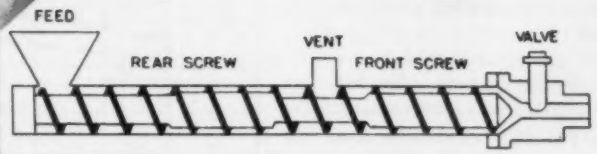

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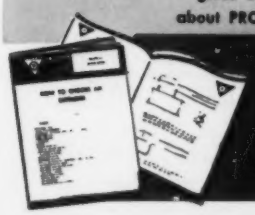

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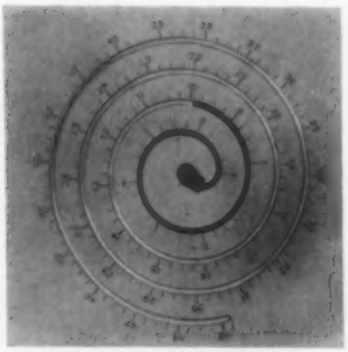


Fig. 3: Templet used in measuring length of flow in spiral mold; 10-in. molded spiral is being measured

furthest away from the gate to provide uniform cooling. Molds that are too cold will give short shots, strained parts, dull finish, and weak welds. If the mold is too hot, it will cause distortion of the part, sinking, and flashing, and will extend the freezing phase of the cycle.

A case in point would be a deep-draw item such as a wastebasket which is center-gated (Fig. 1, p. 122). Normally the hottest material in the mold when the cavity is filled is around the sprue, since this is the last material to enter the cavity. In the case of a wastebasket it would be at the bottom of the cavity and at the tip of the core. It is, therefore, necessary in most cases to keep this area in the mold as cool as possible and gradually increase the temperature of both the cavity surface and core surface away from the sprue area. This would greatly help the flow of these highly crystalline polymers and decrease cycle times. Smith and Scott (2) gave details on two methods for accomplishing this graded cooling of the cavity.

As a general rule, the mold should be as hot as possible without involving the defects mentioned.

In studying the flow of the polymer in a cavity, the method traditionally used is to make a series of "short shots," i.e., shots that do not fill the cavity. Thus it is possible to judge approximately where the wall thickness must be increased to balance out the flow so that all the polymer flows to the parting line of the mold at practically the same time. Here the spiral-flow-mold method recently introduced by Griffiths (3) and Imig (4, 5) is used.

Spiral flow tests

The spiral-flow mold used here was an Archimedes' spiral 49 in. long with ⅛-in. full-round cross-section and interchangeable gate blocks. Figure 2, p. 122, shows the mold mounted in a 3-oz. Moslo injection machine in open position, while Fig. 3, left, shows the templet used to check the length of the spiral obtained. All the test moldings were measured after 48 hr. under controlled atmospheric conditions.

Figure 4, below, indicates the flow in inches vs the mold temperature at 19,000 p.s.i. and at

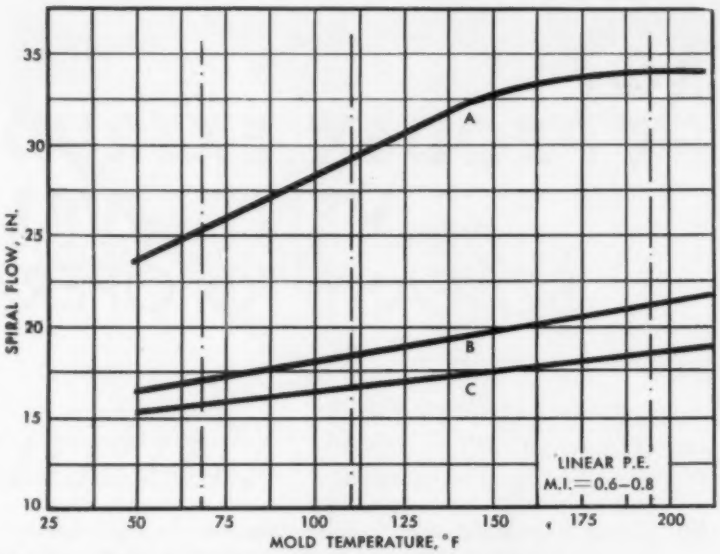


Fig. 4: Effect of mold temperature on flow in spiral mold at various material temperatures. Curve *A* is for a melt temperature of 625° F.; *B* is for 525° F.; *C* is for 375° F. Injection pressure was 19,000 p.s.i., cycle was 40 seconds

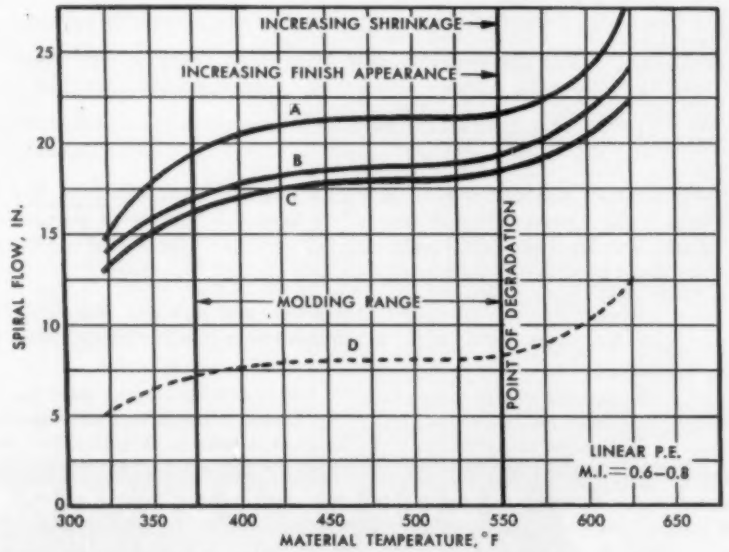


Fig. 5: Increasing the melt temperature improves flow but causes degradation above 550° F. Curves *A*, *B*, and *C*—ram pressure 19,000 p.s.i., mold temperature 195, 110, and 70° F., respectively. Curve D—8000 p.s.i. and 70° F.

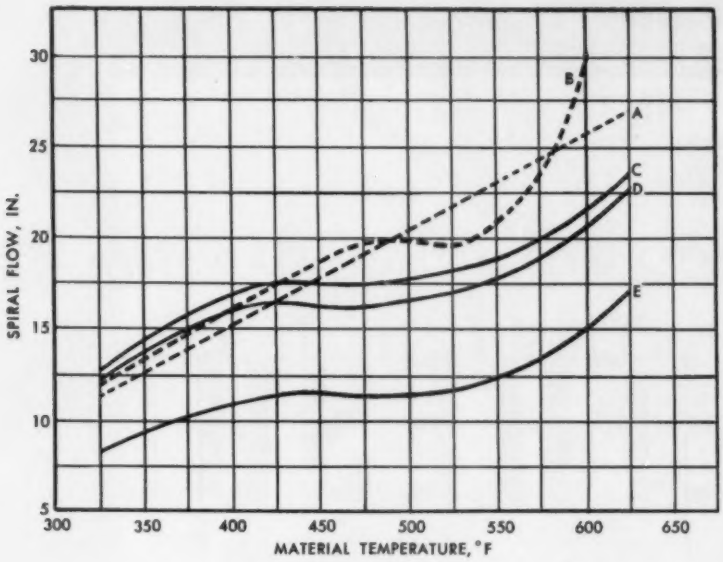


Fig. 6: Flow versus melt temperature for different resins. Curve *A*—high-impact polystyrene; *B*—branched polyethylene (PE) of 2.7 melt index (MI); curves *C*, *D*, and *E*—linear polyethylene of MI = 5.0, 3.2, and 0.76, respectively

material temperatures from 375 to 625° F. The cycle took 40 seconds. It can be seen from these graphs that mold temperatures affect flow in a nearly linear relationship. Increased temperature increases flow. Similar effects of about the same magnitude were observed in branched polyethylene by Imig (5). There is a marked improvement in flow at the highest melt temperature. At 625° F., however, the material suffers some degradation, with resultant reduction in mechanical properties of the moldings. In many cases the molder will use extremely high temperatures to fill a mold successfully and get a good finish on the molded item. Many items tested after molding were found to have higher melt indexes than the original molding powder, indicating reduced molecular weights.

Figure 5, p. 124, illustrates more vividly the increase in flow with rising material temperature and shows that within the normal molding range for linear polyethylene there is little change in its flow characteristics. This agrees with the findings of Griffiths (3), who found that the spiral flow of polyethylenes increased only slightly with cylinder temperature over the range from 265 to 570° F. However, after the material has passed 550° F., the flow increases sharply, probably because of molecular degradation. Degradation was unusually severe in this work because the shot was a small part—about one-seventh—of the shot capacity of the machine, and because the cycle was relatively long. (The reason for this was to insure temperature recovery between shots.)

Figure 6, above, shows this dependence of flow in the spiral mold on melt temperature for five different resins at 10,000 p.s.i. on a 40-sec. cycle. Notice that the flow of polyethylenes is not as temperature-sensitive as that of high-impact polystyrene. Note also that the linear type having a melt index (MI) of 3.2 (or even 5.0) does not give as much flow as the branched polymer of MI 2.7, thus confirming the observations of commercial molders. This is partly because the branched material has a higher flow at molding conditions than the linear type, and partly because the linear melt freezes at a higher temperature, therefore, sooner, and has less time for flow. These results also point out the inadequacy of MI as a measure of flow under molding conditions. This point is made even clearer by Fig. 8, p. 128, which shows how the flow of these materials in the melt indexer changes with temperatures.[2] The effect of temperature is much greater here than in the spiral mold, but the divergence between branched and linear polymers is still plain. Both the linear polymers increase in flow rate by a factor of about 3.4 over the range from 374 (left ends of curves) to 575° F., whereas the branched polymer flows 9.6 times as fast at 575 as at 374° F. At the official melt index temperature, 374° F., the flow distances in the spiral mold of these different polymers (Fig. 6, above) are in the proper order, though much closer together than one would suppose from the melt indexes—a 6.6-fold difference in MI corresponds to only a 1.5-fold difference in spiral flow.

Figure 7, p. 128, is a chart showing flow vs. injection pressure at four different mold temperatures at a melt temperature of 475° F. Flow into the spiral mold increases with increasing pressure.

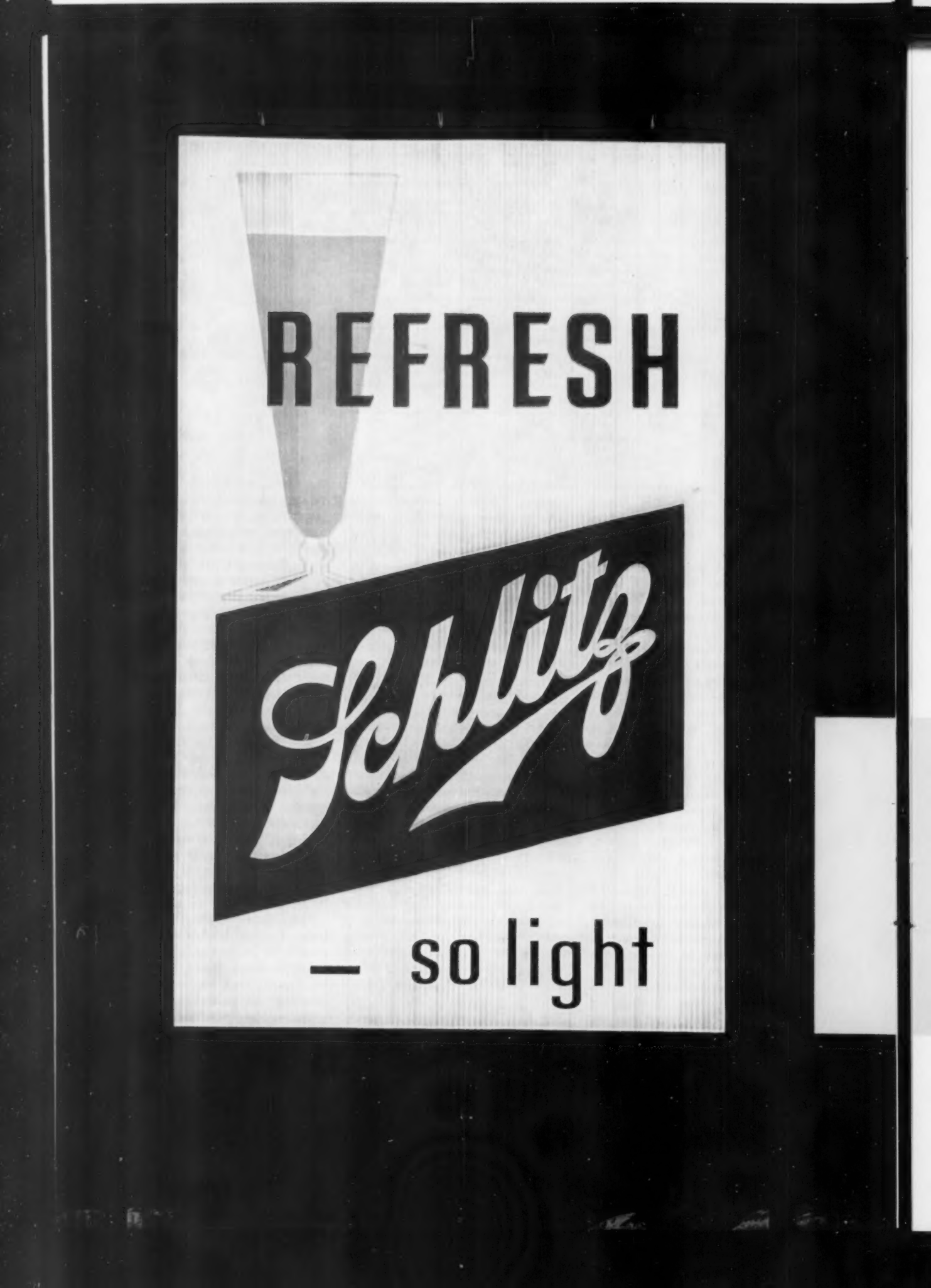
Gate design

There is no doubt that many types of gating designs have been used in injection molding throughout the years. However, what might work very well in one case may not do well in another.

The molding machine, the nature of the material, the runner system, and the cycle time all have a marked influence on the gate design. In a majority of the cases, the trial and error method has been employed to produce a quality part at an economical cycle,

(*To page* 128)

[2]Melt index is measured by A.S.T.M. test D 1238-52T, and is the rate in decigrams/min., at which polyethylene flows out through a hole 0.0825 in. in diameter and 0.315 in. in length, under a pressure of 43.5 p.s.i. at 275° F.—Ed.


REFRESH
Schlitz
— so light

The bigger the sign, the greater the need for a tough plastic like Tenite Butyrate

Giant plastic sign is 40 feet high, 25 feet wide and contains 3000 pounds of Butyrate plastic

Remember this use of Tenite Butyrate, the next time you're looking for a tough plastic that must endure outdoor exposure.

Reputedly the largest plastic-faced structure in the world, this illuminated sign measures 25 by 40 feet and is mounted on a steel structure 52 feet high. The plastic alone weighs 3000 pounds. It's truly a giant, but there's more of a story here than mere size.

To protect the investment needed to build such a sign, the designers had to choose a plastic that was tough enough to survive handling and erection hazards, sturdy enough to endure whatever impacts would be encountered, rigid enough to resist any buckling throughout its 40-foot length, resilient enough to absorb the twisting effect of strong winds...and weather-resistant enough to take the rigors offered by Midwest summers and winters.

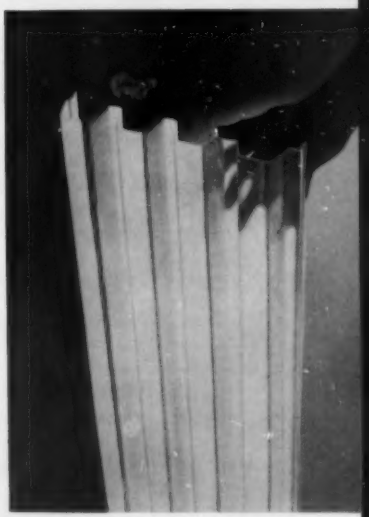
In Tenite Butyrate, the designers found a plastic that could meet their performance requirements. For many years this Eastman plastic has been proving its toughness and weather durability in hundreds of outdoor applications.

Another advantage of Tenite Butyrate was its good working properties and the ease with which it could be extruded into the necessary corrugated form shown at the right. For this sign was not made by piecing together short panels of plastic; instead, the sign was fabricated by interlocking 40-foot lengths of corrugated extrusions, each one foot wide. All decorating on the white sign face was done by overlaying sheets of Tenite Butyrate in various colors. These can be changed at will to vary the advertising message.

What jobs do you have for so versatile a plastic as Tenite Butyrate? Its mechanical properties, its outdoor durability, its easy workability, and its availability in any color in clear, opaque or variegated forms result in uses ranging from the popular new color telephones to pipe for carrying corrosive fluids. To discuss any use you might have for Tenite Butyrate, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

SIGN DETAILS: Sign constructed by Everbrite Electric Signs, Inc., 1440 N. Fourth St., Milwaukee 12, Wisc. Unit conceived and designed by Jos. Schlitz Brewing Company, Milwaukee 1, Wisc. Corrugated sheet extruded by Southern Plastics Company, 408 Pendleton St., Columbia, S. C. Overlay sheets extruded by Southern Plastics Company and by Midwest Plastic Products Company, 1801 Chicago Rd., Chicago Heights, Ill.

CLOSE-UP shows extruded construction of sign face. Sign is so bright, a newspaper can be read by its light 3 blocks away. Development of giant sign took years of planning.



TENITE
BUTYRATE
an Eastman plastic

to study some effects of various gate designs, five of the most common types were picked to evaluate their results on the flow of linear polyethylene. The results of these evaluations are shown in Fig. 9, p. 129.

Gate 1, with a ⅛-in. full-round section, is the block used in all our standard tests to determine the relative flow of one thermoplastic *vs* another. It yields a greater flow than the others because it is least restrictive.

Gate 2, a diverging-type pinpoint gate 30 mils in diameter, is used to reduce back flow from the cavity after the ram is retracted. The converging (in the back-flow direction) design is thought to cause a wedging action that discourages flow. There is hardly any difference in flow behavior between this type of gate and the first one.

Gate 3, a converging-type pinpoint gate 30 mils in diameter, is used commercially in many applications where a clean break between the molded part and the gate is required. This gate gives the poorest flow rate, possibly because of the wedging effect just mentioned.

Gate 4 is the exact size of Gate 3 but shows an increased flow rate. In Gate 4, the cold slug wells have been extended beyond the actual land point to trap the already-chilled flow front that tends to block off the gate. The hot plastic material now has a chance to flow freely into the spiral.

Gate 5 is a slit-type gate 62 mils wide by 30 mils deep with a short land. This type is used in many mold designs. It apparently offers no advantage over a good pin-point design insofar as flow into the spiral mold is concerned.

It is evident that more pressure is required to fill a long-flow cavity when the gate is small, but the difference is not as large as might be supposed. Where the machine has plenty of power, the viscous working at the small gate is a good way to reheat the polymer just before it enters the cavity to improve the finish and flow. This type of gating also minimizes postfinishing of the molded part.

The effects of gating on molding shrinkage, warping, and strength on linear polyethylene moldings are well covered in (6).

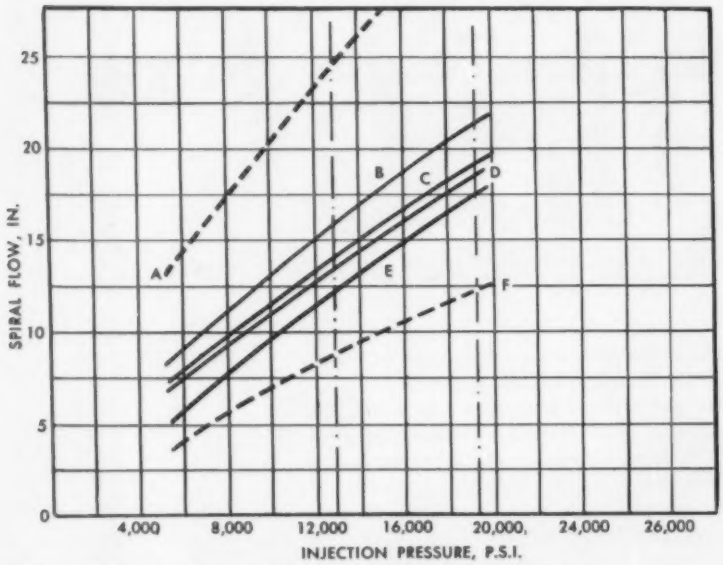


Fig. 7: Other molding conditions shift curves of flow versus pressure. Curves *B*, *C*, *D*, and *E*—melt temperature was 475° F., mold temperatures were 195, 150, 110, and 70° F., respectively. Curves *A* and *F* represent extremes reached in this study; for *A* melt temperature was 625° F., mold temperature 195° F.; for *F*, 325 and 70° F., respectively

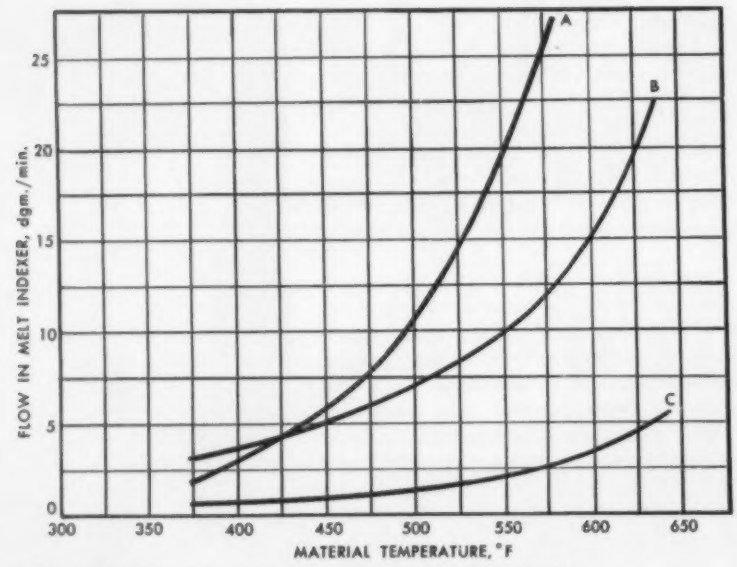


Fig. 8: Flow in laboratory instrument is more sharply influenced by changes in melt temperature than flow in spiral mold. Curves *A*, *B*, and *C* are for branched PE of 2.7 MI, linear PE of 3.5 MI, and linear PE of 0.76 MI, respectively

Mold design

Some of the important things that should be kept in mind in considering mold design are: more-than-usual need for generous runners, large sprues, and large nozzle-hole sizes. Large gates are usually required for heavy-section moldings.

Internal restrictions to flow and sharp changes of direction within the mold should be held to a minimum. Sharp changes in section thickness should be avoided to

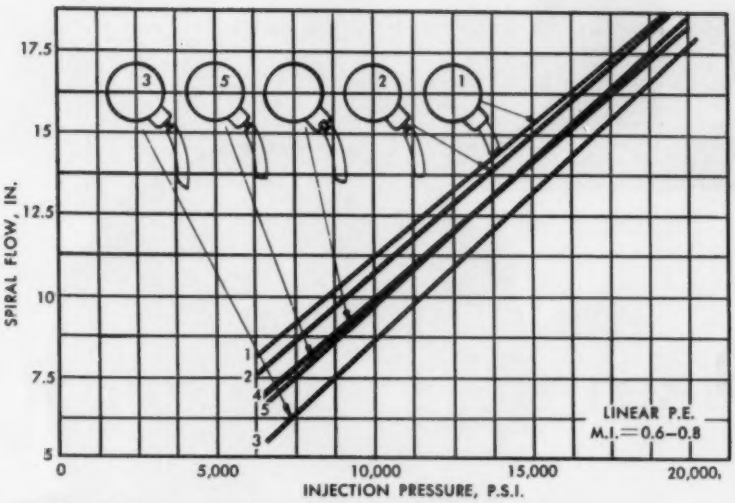


Fig. 9: Effect of gate design on flow-vs-pressure characteristics in spiral mold. Material temperature was 475° F., mold temperature was 110° F. Design of gate probably has a greater effect on filling time in commercial molds than these relatively small differences in spiral flow distance would seem to indicate

prevent sinks and points of stress concentration. Proper gating is a very important factor for the production of good-looking parts of linear polyethylene (6).

All multi-cavity molds should be designed with the shortest possible runners and should have gates balanced for uniform fill of each cavity. The primary runners should be extended beyond the furthest secondary runner to act as cold slug wells.

A cold-slug well should also be provided at the sprue end wherever possible. It should be sufficiently deep to accommodate large nozzle slugs. Sprue-gated or center-gated parts that cannot be provided with cold-slug wells will often show blemish spots around the area opposite the sprue. In such cases, a reverse-taper type of nozzle would be very helpful if the nozzle is kept at the highest cylinder temperature so as to avoid freezing of the polymer at the nozzle end between shots.

Multi-gating a large part is often desirable to obtain rapid fill at lower temperatures and pressures. The principal deficiency of multi-gating is the creation of extra weld lines and resulting expensive finishing costs. All gates on a multi-gated part should be balanced to assure uniform fill with the final weld taking place at far edge of the molded part.

A part that is multi-gated should be gated at points where the material will reach a complete shot at about the same time in all parts of the cavity. The part should be designed or gated to allow the air to escape from the mold and not cause compressed-air burning and weld lines. Special attention may have to be given to venting.

Heating cylinders

Plasticating chambers should have high plasticating capacities and low pressure drops in order to successfully mold linear polyethylene items on an economical cycle. It is known that on many injection machines that have a conventional type of heating cylinder, the material, as it is ejected from the nozzle, can vary in temperature as much as 30 to 40° F. This variation can cause undue strains in the molded part, leading to mechanical failure in service. We believe that the material should be homogenized to a uniform temperature at the point of injection into the mold. Latest heating cylinder design techniques such as the melt-extraction-type heating cylinder (7), polyliner types (8), and those designed to actually mix the plastic material, can definitely improve temperature uniformity of the melt. Those designed to reduce the pressure drop encountered in all types of heating cylinders, which in many cases amounts to 50% of the total force exerted on the injection piston, should also make it easier to mold linear polyethylene economically.

Since a preplasticator contains only melt, the ram pressure is fully transmitted to the nozzle. Thus, within the limitations of the usual hydraulic systems, higher injection pressures and filling rates can be achieved with a preplasticator than with a single-cylinder machine. A preplasticator also increases heating capacity of the machine, thus increasing its shooting capacity and permitting faster cycles (9, 10).

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Dr. Gordon M. Kline, Technical Editor

Polycarbonate resin

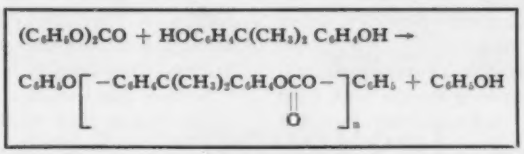
A tough, heat-resistant, dimensionally stable thermoplastic

By R. J. Thompson† and K. B. Goldblum†

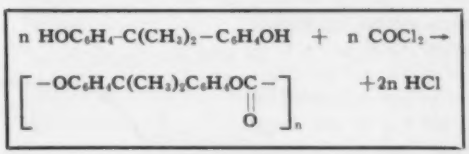
In this day of innovations, it takes an exceptional material to register any impact on an industry that is growing as rapidly as the plastics business. Lexan[1] molding compound promises to be such a product. It is a thermoplastic polymer suitable for injection molding or extrusion. But why has this newcomer aroused so much interest in the plastics field?

Lexan molding compound offers a unique combination of useful properties unmatched by any other thermoplastic product. Four outstanding properties are combined in this new material. 1) *High impact strength:* over 12 ft.-lb./in. of notch; 2) *excellent dimensional stability:* low water absorption and 280 to 290° F. heat distortion temperature minimize dimensional changes; 3) *superior heat resistance:* shows excellent resistance to thermal-oxidative degradation at temperatures up to 300° F.; 4) *good electrical properties.* It is not offered as a replacement for any particular plastic product, but rather as a versatile raw material which can open up new applications and designs, and generally extend the range of usefulness of thermoplastic resins.

This resin also introduces an entirely new composition to the thermoplastic family. The polycarbonate name is taken from the carbonate linkage which joins the organic units in the polymer. This is the first commercially useful thermoplastic material which incorporates the carbonate radical as an integral part of the main polymer chain.



Formula 1



Formula 2

Manufacture

The aromatic polycarbonates can be readily manufactured by one of two general methods: 1) ester exchange or fusion cook and 2) phosgenation.

Ester exchange: The synthesis using the ester exchange method involves the interaction of a carbonate diester and a dihydroxy aromatic compound. In the case of Lexan polycarbonate resin, diphenyl carbonate and bisphenol A (2,2-bis [4-hydroxyphenyl] propane) are reacted together as shown in Formula 1.

The reaction mixture is held at 200 to 230° C. and 20 to 30 mm. Hg pressure until 80 to 90% of the phenol of condensation has been removed. At this point the temperature is raised to 290 to 300° C. and the pressure is reduced to below 1 mm. Hg. As the reaction proceeds, the melt viscosity increases and the molecular weight

* Reg. U.S. Pat. Off.
† Chemical and Metallurgical Division, General Electric Co.
[1]Lexan is the name chosen by General Electric Co. as a trademark for its new polycarbonate resin.

Table I: Advantages and disadvantages of the various systems for making polycarbonates

Ester exchange	*All-pyridine*	*Partial pyridine*	*Aqueous-inert solvent*
	ADVANTAGES		
No solvents	No molecular weight limitation	No mol. wt. limitation	No mol. wt. limitation
No solvent recovery	Run under moderate conditions	Run under moderate conditions	Run under moderate conditions
Resin obtained in densified form	Simple equipment	Simple equipment	Simple equipment
		Lower cost solvents	No costly solvents
	DISADVANTAGES		
Equipment limitations	Pyridine costly as solvent	Solvent recovery system needed	Solvent recovery system needed
More difficult to get high mol. wts.	Very efficient solvent recovery necessary	At least three solvents must be recovered	At least two solvents must be recovered
High temp. and high vacuum with leak proof operation necessary	Polymer must be purified	Polymer must be purified	Polymer must be purified
	Polymer must be densified	Polymer must be densified	Polymer must be densified

grows. The resin can be removed from the reaction vessel by extruding it under pressure, using an inert gas.

Because of the equipment limitations imposed by the high melt viscosity, only polymers of limited molecular weight can be made by the fusion method in stirred kettles. However, further reaction can be carried on using vacuum rolls by which resins of higher melt viscosities have been prepared. For example, resins of intrinsic viscosity (as measured in p-dioxane at 30° C.) in the range of 0.6 to 0.7 have been made regularly in stirred kettle reactions. The use of vacuum rolls has made possible the preparation of resins with intrinsic viscosity greater than 1.5.

Experimental work has indicated that an initial excess of the carbonate ester is desirable both from the stability and from the volatility points of view. With regard to stability, the excess of ester insures the more rapid and complete reaction of the bisphenol which may decompose if held above 180° C. unless esterfied. The volatility of diphenyl carbonate compared to that of the bisphenol facilitates the removal of this ester and allows the reaction to proceed more readily.

Among the variations possible in the fusion cook method is the use of a monomeric biscarbonate ester of the bisphenol which upon condensing with itself by splitting out a simple carbonate ester forms a polymeric molecule. Catalysts can be used. Basic catalysts are much more effective than acid catalysts. The equipment must be quite leakproof since a small leak that allows air to pass through the very hot reaction melt will give a cross-linked, useless product.

Phosgenation: The introduction of the carbonate linkage by means of phosgene is the basis of the other general method used. This scheme has at least three variations which are worthy of discussion: 1) all-pyridine system; 2) partial pyridine system; and 3) aqueous—inert solvent system.

It is obvious that as phosgene reacts with bisphenol A, hydrogen chloride is evolved as shown in Formula 2, p. 131.

The nature of the end groups, either *H* or *Cl* or a mixture of both, will depend on the ratios of the reactants.

In the all-pyridine system the pyridine functions as the hydrohalide acceptor, as the solvent, and, in addition, possibly as a catalyst. When phosgene is bubbled into a stirred solution of the bisphenol in pyridine, a somewhat exothermic reaction occurs. At some point in the reaction, which depends on the temperature of the reaction mixture, pyridine hydrochloride begins to crystallize out of the mixture. As the stoichiometric amount of phosgene is reached, the reaction mixture quite suddenly becomes very viscous. The polymer may be recoverd by being precipitated from

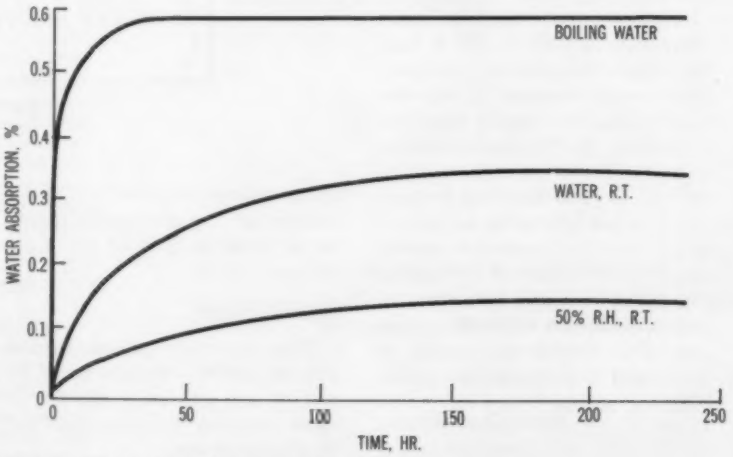
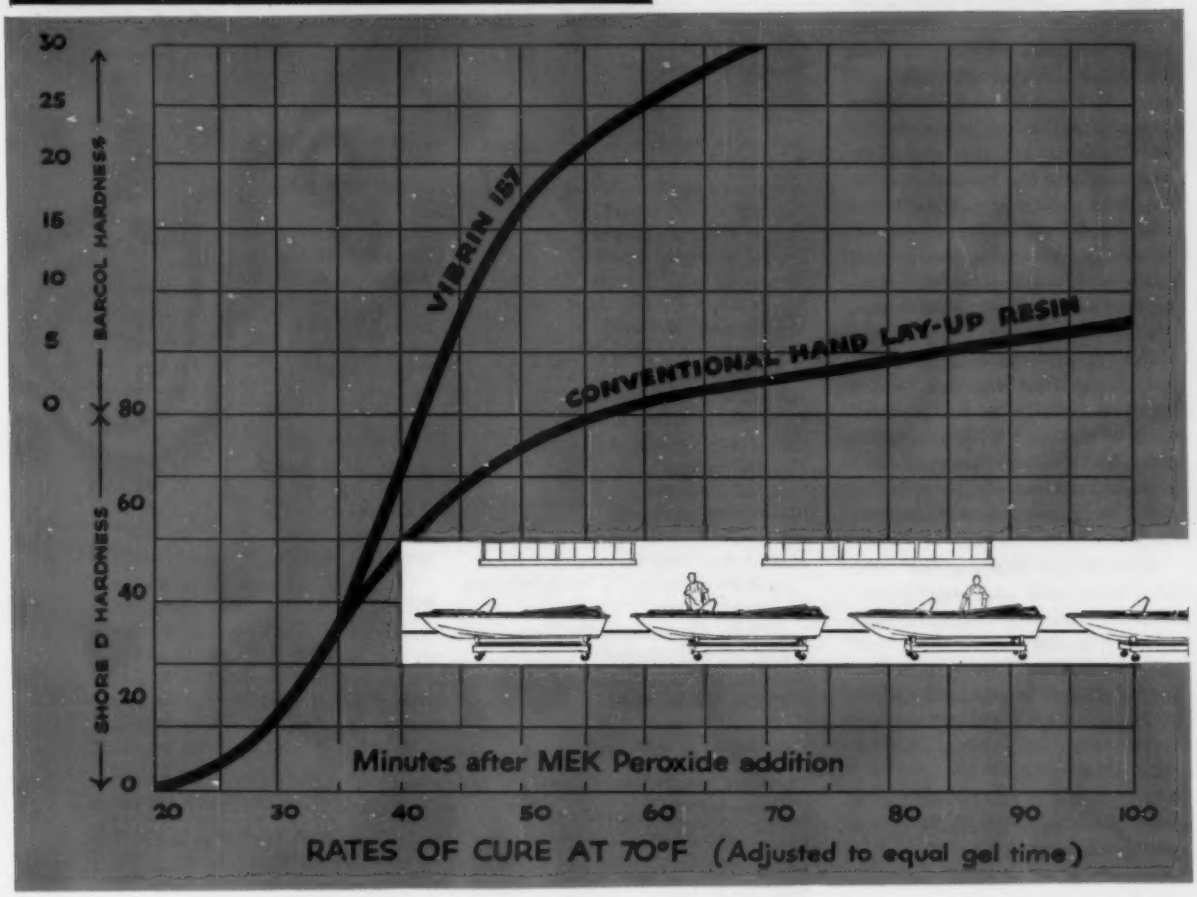


Fig. 1: Water absorption *versus* time

Naugatuck VIBRIN LIQUID POLYESTER RESINS



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VIBRIN 157 gives extremely rapid wetting of fiber glass, but it is sufficiently thixotropic to prevent drain-out. It is also designed to operate at low catalyst levels, permitting maximum production economies.

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the reaction mixture by a non-solvent such as methanol or isopropanol.

The temperature of reaction, the concentration of the bisphenol, the rate of addition of phosgene, the purity of the bisphenol, the amount of water, and impurities in the pyridine have greater or lesser effects on the molecular weight attainable by this system. Reactant purity is probably the most important variable; consequently much time and effort have been spent in determining the degree of purity that is necessary.

The main difference between the all-pyridine and the partial pyridine systems is the replacement of that part of the pyridine which has a solvent function with a lower-cost solvent in order to make the process more economical.

Solvents for the polymer that have been used successfully are: benzene, toluene, chlorobenzene, dioxane, methylene chloride, and trichlorethylene. The pyridine has been retained solely as a hydrohalide acceptor. Other tertiary amines have also been successfully used.

The partial pyridine reaction is carried out very similarly to the all-pyridine reaction described above. The amount of pyridine can be varied from the stoichiometric ratio on up. The control of molecular weight can be achieved by the control of the same variables described above. Care must be taken in the use of the variables to control the molecular weight since interaction has been found between them in some cases. Special care must be exercised to wash out all of the pyridine and pyridine hydrochloride from the reaction mixture in order that the final precipitated polymer will be free of contamination.

The aqueous-inert solvent system differs from the partial pyridine system in that the pyridine is replaced as a hydrohalide acceptor by an aqueous caustic solution. Good mixing is essential in this scheme because the hydrophobic and hydrophilic portions of the two-phase system must come into intimate contact for good reaction. Quaternary ammonium salts, such as trimethyl benzyl ammonium chloride, act as catalysts in this system for obtaining high-molecular-weight products. The complete removal of sodium from the polymer seems essential to its stability on aging at elevated temperatures.

Since the polymer is obtained in solution, it must be precipitated

Table II: Properties of molded

PHYSICAL PROPERTIES				*A.S.T.M. Test*
Color	Light amber			—
Specific gravity	1.20			D 792
Odor	None			—
Taste	None			—
Refractive index at 25° C.	1.584			—
Rockwell hardness	M70, R118			D 785
Abrasion resistance, Taber abraser with CS-17 wheel	24 mg./1000 cycles			D 1044
Impact strength, notched Izod	12-16 ft.-lb./in. of notch			D 256
Impact strength, unnotched Izod	600/900 ft.-lb./cu. in.			
Tensile-impact (Bragaw, MODERN PLASTICS 33, 199; June 1956)	600-900 ft.-lb./cu. in.			—
Tensile yield strength	8,000-9,000 p.s.i.			D 638
Tensile ultimate strength	9,000-10,500 p.s.i.			D 638
Tensile modulus	320,000 p.s.i.			D 638
Elongation	60-100%			D 638
Compressive strength	11,000 p.s.i.			D 695
Compressive modulus	241,000 p.s.i.			D 695
Flexural strength	11,000-13,000 p.s.i.			D 790
Flexural modulus	375,000 p.s.i.			D 790
Shear yield strength	5,400 p.s.i.			D 732
Shear ultimate strength	9,200 p.s.i.			D 732
Light transmission (4 in. diam. by ⅛ in. thick disc)	58%			—
Light reflectance (4 in. diam. by ⅛ in. thick disc)	9%			—
Water vapor transmission	$3\text{-}4 \times 10^{-6}$ g./cm./hr./cm.²/mm. Hg			—
Nitrogen transmission	0.012×10^{-6} cc./mm./sec./cm.²/cm. Hg			—
Bulk factor of pellets	1.74			—
Coefficient of friction (unlubricated)	*Low speed (1 cm./sec.)*		*High speed (173-202 cm./sec.)*	
Lexan on Lexan	0.24		ca. 2.0	
Lexan on steel	0.73		0.82	
Steel on Lexan	0.35		0.45	
THERMAL PROPERTIES				
Heat distortion temperature	264 p.s.i.: 280-290° F.			D 648
	66 p.s.i.: 283-293° F.			D 648
Mold shrinkage	0.005-0.007 in./in.			D 955
Thermal conductivity	4.6×10^{-4} cal./sec./cm.²/°C./cm.			—
Coefficient of linear thermal expansion	7×10^{-5} in./in./°C.			D 696
Crystalline melting point	514° F.			—
Flammability	Self-extinguishing			D 635
Shrinkage on aging 2000 hr. at 125° C.	0.001 in./in.			—
Melt viscosity at 300° C.	4,000-6,000 poises			—
Brittle temperature	−135°C.			D 746
	Temp.,°F.	*Load, lb.*	*Deformation, %*	
Deformation under load on 0.5 in. cube	158	1000	0.282	D 621
	158	500	0.080	
	77	1000	0.220	
	77	500	0.101	

Lexan polycarbonate resin

ELECTRICAL PROPERTIES

	−30°C.	−3°C.	23°C.	100°C.	125°C.	
Dielectric constant						
60 cycles	3.12	3.14	3.17	3.15	3.13	D 150
10^6 cycles			2.96			D 150
Power factor						
60 cycles	0.005	0.004	0.0009	0.009	0.0011	D 150
10^6 cycles			0.010			D 150
Volume resistivity, ohm-cm.	$>10^{17}$	$>10^{17}$	2.1×10^{16}	2.1×10^{15}	2.0×10^{14}	—
Arc resistance, stainless steel strip electrodes			10-11 sec.			D 495
Dielectric strength short time, 25°C.	3,910 v./mil at 1.5 mils					D 149
	3,080	3.0				
	2,560	4.7				
	1,130	23.				
	400[a]	125.				
Dielectric strength short time, 100°C.	3,380 v./mil at 3.0 mils					D 149
	1,250	23.				
	600[a]	125.				
Resistance to electron beam radiation	No change up to 50 mr. dosage					—

CHEMICAL PROPERTIES

Water absorption, 24 hr. immersion	0.3%	D 570

Stable to: water, dilute mineral and organic acids, aliphatic hydrocarbons, and alcohols.
Attacked and decomposed by: alkaline solutions, ammonia, and amines.
Easily soluble in: chlorinated hydrocarbons.
Partially soluble in: aromatic hydrocarbons, ketones.
Resistant to: tea, coffee, grape juice, orange juice, tomato juice, catsup, tincture of iodine, and merthiolate.

MISCELLANEOUS PROPERTIES

Outdoor exposure for 1 yr. at Pittsfield, Mass.: no change in appearance.
Exposure to G. E. sunlamp at 6 in. distance for 6 wk.: slight yellowing.

[a]The step-by-step values are essentially the same as the short time values for the 125 mil pieces.

or otherwise recovered, as in the other solution systems. The recovered, dried polymer can be densified for further operations, by extrusion and chopping, or cold pressing into pellets.

Each of the systems has its own inherent advantages and disadvantages (see Table I, p. 132). The ultimate choice in any particular case will have to rest on a complete study of each process and the economic considerations involved.

Processing

The aromatic polycarbonate resins have been processed by virtually every method and technique used in thermoplastic technology. The densification of the polymer particles from the manufacturing step by extrusion and chopping has been referred to above. Further, the polymer may be injection, transfer, or compression molded; cast; flat or blow extruded into films or sheets; vacuum formed; spun into fibers; and applied to surfaces from solution or by fluid bed techniques. The films are heat-sealable. Parts may be welded with a hot-air torch or cemented with solvents. The excellent machinability of polycarbonate parts has been demonstrated in practically every machining operation.

Since the first product objective in the Lexan polycarbonate resin development has been an injection molding compound, most work has been done in the injection field. The cylinder temperatures for injection are in the 500 to 575° F. range. However, because of the excellent thermal stability of the resin, temperatures as high as 700° F. have been successfully used. Because of high melt viscosity of the polymer, it is suggested that the maximum pressure of the injection machine be used. Short mold filling times are preferred so that freezing off in the runners and at the gates is minimized. Gate size is somewhat open to debate. In many cases, a larger gate has been used to get good parts but, in others, quite small and restricted gates have produced satisfactory moldings. The lands should be as short as conveniently possible. The runners preferably should be large and full round. The sprue also should be large. A heated nozzle is preferred, but good moldings have been made with unheated nozzles. Molds at room temperature have been used successfully in many cases, although more usually temperatures of 170 to 200° F. are recommended. Since molding of polycarbonate resin is affected by

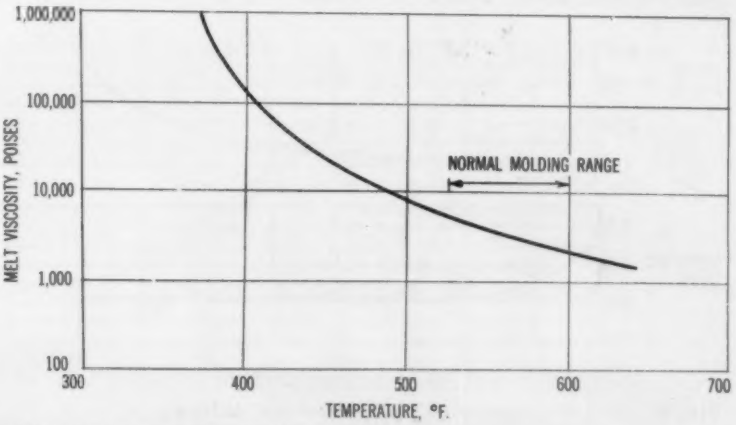

Fig. 2: Melt viscosity *versus* temperature

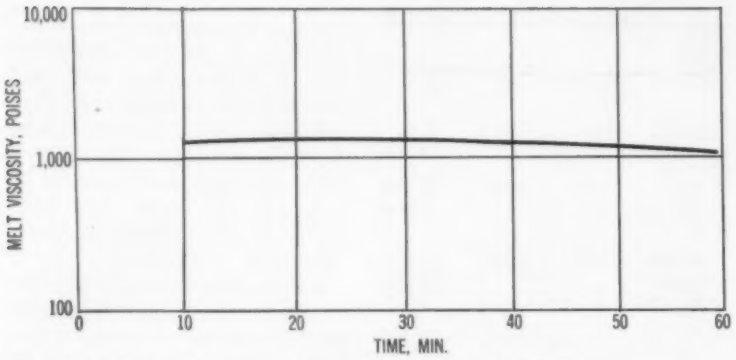

Fig. 3: Melt viscosity *versus* time. (Sample tested at 300° C.)

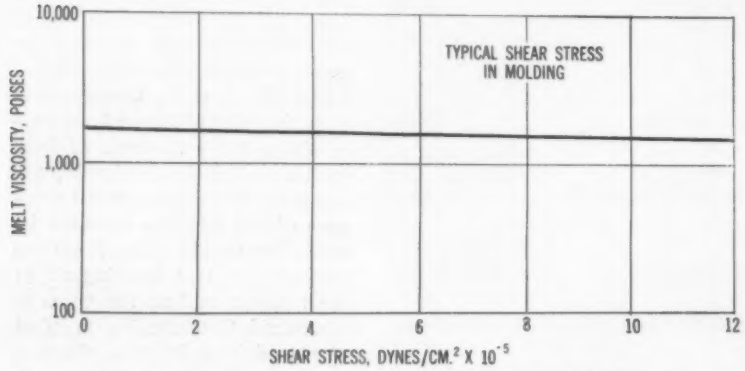

Fig. 4: Melt viscosity *versus* shear stress. (Sample tested at 300° C.)

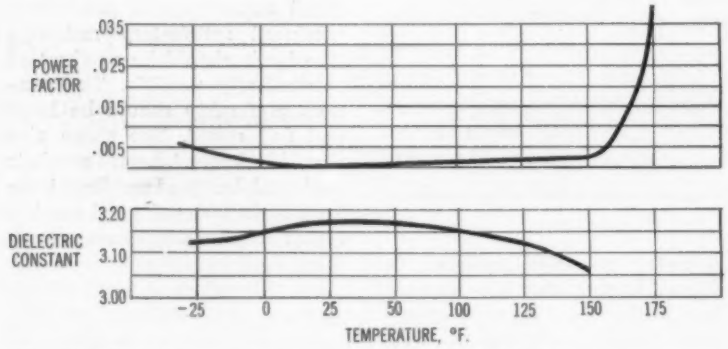

Fig. 5: Effect of temperature on power factor and dielectric constant at 60 cycles

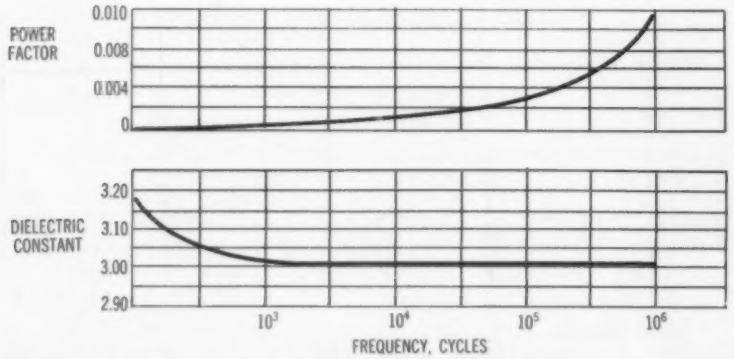

Fig. 6: Effect of frequency on power factor and dielectric constant at 23° C.

moisture which shows up as streaking and bubbling and leads to poor physical properties, drying in shallow layers of not over 1 in. in depth at 110 to 125° C., preferably in dehumidified ovens, is suggested.

The experimental information on extrusion conditions indicates that temperatures of 450 to 550° F. can be used in the barrel. Water cooling of the screw is not recommended due to the high melt viscosity developed. Even more important than in injection molding, the feed to the extruder must be as moisture-free as possible. The presence of moisture will be indicated by small bubbles in the body of the extruded shape. If the moisture content is high enough, the extruded material will be foamy in appearance.

Only preliminary data are available with regard to the other methods of fabrication. However, enough has been done to indicate promise in products made by these methods.

Properties

The physical properties that have been collected to date are given in Table II, p. 134. Unless otherwise indicated, the tests have been made at room conditions.

Low water absorption of molded parts is important because moisture often affects dimensional and chemical stability, and mechanical and electrical properties. Polycarbonate resin exhibits a relatively low water absorption, as shown in Fig. 1, p. 132. Exposed to 50% relative humidity at room temperature, polycarbonate resin parts reach equilibrium in about 10 days at 0.15% water content;

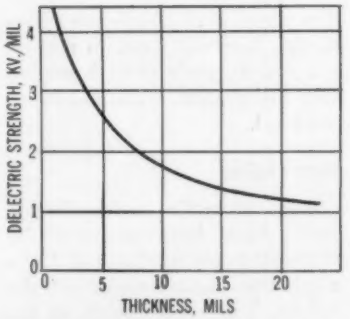

Fig. 7: Dielectric strength *versus* thickness

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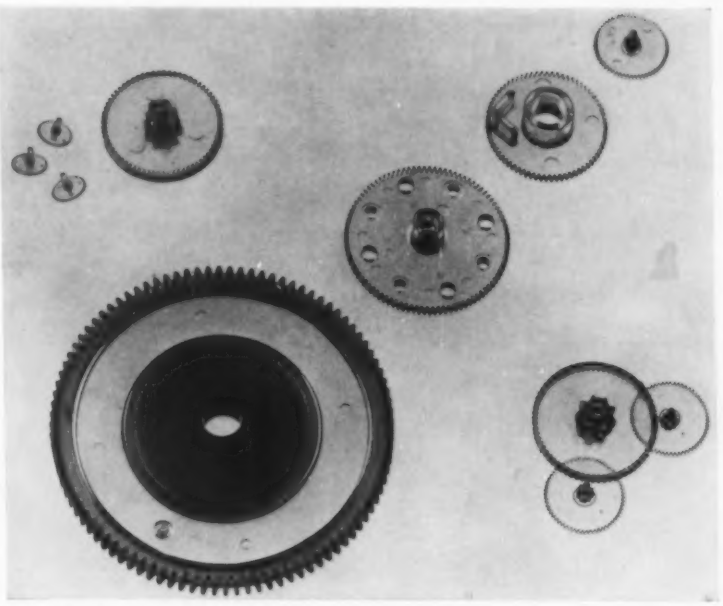


Fig. 8: Gears molded of polycarbonate resin. In several, the assembly of gear, pinion, and shaft is molded as one piece

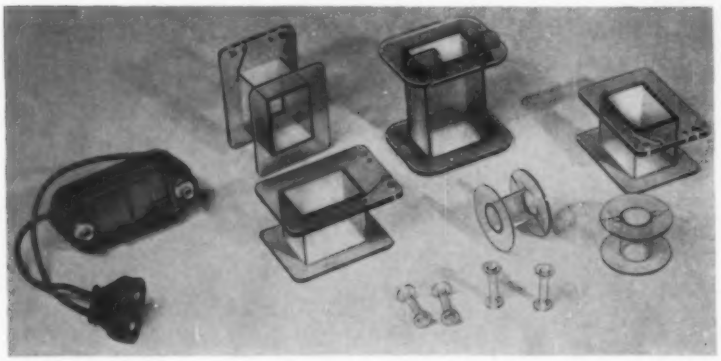
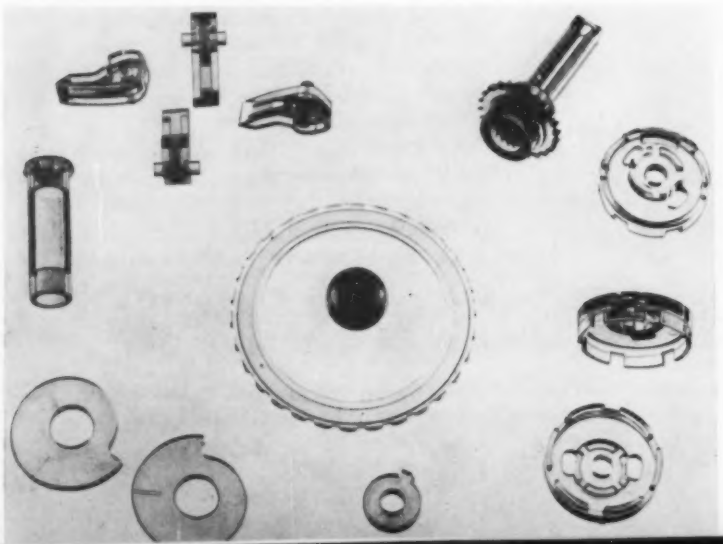


Fig. 9: Polycarbonate coil forms. Small forms in foreground are approximately ½ in. long. At left is a coil encapsulated by injection molding polycarbonate around it

Fig. 10: Cams, bushings, bearings, and other moldings illustrate variety of industrial parts that can be made from polycarbonates



when immersed in water at room temperature, a maximum of 0.35% is absorbed. In boiling water the maximum absorption of 0.58% is rapidly attained.

Figure 2, p. 135, shows the melt viscosity of polycarbonate resin *versus* temperature. Like other amorphous polymers, polycarbonate resin has no precise melting point. It softens and begins to melt over a range from 420 to 440° F.

Significant in the processing of the resin is its thermal stability. Figure 3, p. 136, shows that the melt viscosity remains virtually unchanged over a 60-min. period of heating at 300° C. (572° F.). Another, somewhat unique, characteristic of the resin is the fact that melt viscosity is not significantly affected by increases in pressure. Figure 4, p. 136, covers a range in shear stress from 0 to 150% of the average shear stress used in normal injection molding. Over this broad pressure range, polycarbonate resin shows only a very slight decrease in melt viscosity.

Polycarbonate resin has good electrical properties which make it suitable for applications where insulation characteristics are needed. Of especial interest is the low power factor of 0.0009 at 60 cy./sec. at room temperature. The effects of temperature and frequency on power factor and dielectric constant are shown in Figs. 5 and 6, p. 136. Figure 7, p. 136, shows the increase in dielectric strength at 25° C. as the thickness is decreased; the value for polycarbonate resin on the standard A.S.T.M. thickness of 125 mils is 400 v./mil.

Applications

If a plastics engineer were looking for an ideal plastic, impact strength would probably be a prime requirement. The fact that polycarbonate resin has exceptionally high impact strength suggests its use in applications where toughness is a requisite. Housings for business machines, communication equipment, and electrical apparatus fall in this category. The colorability of polycarbonate resin, its transparency and self-extinguishing rating enhance its suitability for such applications. Handles and structural parts may

(*To page* 218)

Mechanical properties of thin polyethylene film

By A. A. Anderson and G. L. Morfitt**

An apparatus is described for the determination of the stress-strain characteristics of thin plastic films at elongation rates of 0.03 to 6 in./sec. and at temperatures down to −70° C. The effects of temperature and rate of elongation on the stress-strain properties of high-molecular-weight, high-pressure polyethylene film and its heat seals are discussed. In general, the ultimate strength and yield stress of the film and seals increase with decreasing temperature. The ductility and rupture energy, however, are reduced by lowering the temperature or by increasing the rate of extension. An increase in elongation rate also shifts the ductile-brittle transformation point of the film and heat seal to higher temperatures. A transition in the flow behavior of the film in the region of −15 to −45° C. is described and its effect on the mechanical properties is discussed.

The use of plastic balloons as vehicles for upper atmosphere research has engendered considerable interest in the behavior of thin plastic films under what might be called abnormal environmental conditions. To acquire information on relevant physical and chemical properties of these barrier materials, a research program has been undertaken to investigate the role of temperature and time in determining the values of the basic mechanical properties. It is well known that temperature has a marked effect upon these properties of plastic materials (1-7)[1]. The effect of time, however, has not been examined as thoroughly. Work of this nature has been limited largely to creep and relaxation investigations and to determination of complex moduli from the damping of forced oscillations (8-12).

[1] Numbers in parentheses link to references at end of article, p. 224.

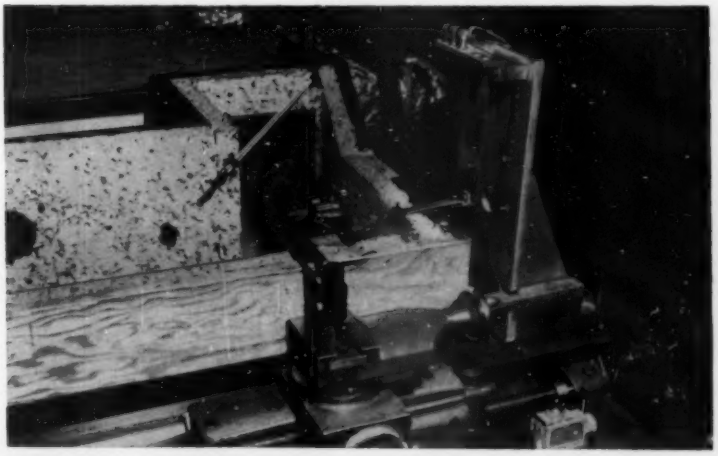


Fig. 1: Tensile testing apparatus

It is the purpose of this paper to present the mechanical property-temperature-time relationships that have been determined for polyethylene film and its heat seals. These data have been accumulated through the medium of tensile tests conducted at various temperatures and rates of elongation. From these tests, it has been possible to determine the effect of temperature and rate on such basic film characteristics as tensile and yield strength, ultimate strain, and rupture energy.

Apparatus and method

The tensile test performed at a constant rate of elongation has been found to be a most convenient and useful tool for investigating the mechanical properties of polyethylene. To permit the use of a wide range of elongation rates, the tensile tester pictured in Fig. 1, left, was developed from a quick-change cabinet model lathe. This instrument develops test specimen elongation rates of 0.03 to 6 in./sec.

A cantilever beam with attached strain gages has been mounted in place of the tailstock assembly to measure the forces resulting from elongation of the test specimen. These forces are recorded by a direct-writing oscillograph. One of the specimen film clamps is attached to this beam and the other is connected to a rigid, fiber-reinforced plastic arm protruding into the test

(*To page* 142)

*Engineering, Research, and Development Activity, Mechanical Div. of General Mills, Inc. The authors are grateful to the Geophysics Research Directorate of the Air Force Cambridge Research Center, which sponsored the research program, for permission to publish this paper.

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Tensile Strength, psi	3400
Elongation, %	30
Izod Impact Strength, ft. lb./in. @ 23°C	1.0
@ 0°C	0.85
Modulus of Elasticity in Flexure, psi x 10^5	3.6
Flexural Strength, psi	8000
Hardness, Durometer D	80

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chamber from the compound rest assembly. This assembly is driven along the lathe bed at a uniform rate by the lead screw. A Microswitch, actuated by the revolution of the screw, is used to record the elongation of the specimen on a second channel of the oscillograph. Although the film at the clamps does not elongate as much as the center area of the test specimen, the errors in strain measurements caused by neglecting this fact are small up to the yield point when the material is brittle. At large strains, correction must be made for slip-out from the film clamps.

For low-temperature measurements, a cork-insulated box was constructed in two separable sections to enclose a portion of the apparatus. Temperatures from +30 to −70° C. are obtained by circulating air through a system composed of a dry ice-isopropyl alcohol chest, tempering chamber, and heating unit. Long wire hooks are manipulated through a slot in the test chamber to place conditioned samples in position for testing and to remove the film clamps after the specimen has broken. As many as nine specimens can be tested at one time without having to open the test chamber.

The polyethylene film used throughout these investigations was extruded by Visking Corp. from Bakelite DFD 5500 resin, a high-molecular-weight, high-pressure polyethylene. Heat seals were formed using a jet of hot air to fuse the film. Tensile test specimens were cut with a razor blade using a rectangular templet. The specimens were 0.395 in. wide, 1.60 in. long, and 0.0020 in. thick. The original length of the specimen between the film clamps has been used to compute strain, and the stress values have been based on the original cross-sectional area.

Samples of film and seals were tested at elongation rates of 0.0357, 0.336, and 1.76 in./sec. at temperatures from +30 to −70° C. Based on the original sample length, and ignoring end effects, these elongation rates correspond to strain rates of roughly 0.02, 0.2, and 1.1 in./in./sec. Nine measurements were made at each condition. The maximum deviation from the average stress and strain values reported here was of the order of 10 percent. The properties of the film were examined in both the machine and transverse direction, i.e., parallel and perpendicular to the direction of extrusion.

Machine direction polyethylene

The effect of temperature on the stress-strain characteristics of machine direction polyethylene is presented graphically in Figs. 2 and 3, below. These curves were determined at a constant elongation rate of 0.336 in./sec. The most striking effect is the change in shape of the initial portion of the stress-strain curve. At +30° C. there is a slight inflection at about 0.3 in./in. strain. As the temperature is lowered by 15° C. increments, this inflection point becomes more pronounced and finally assumes, at −15° C, the form characteristic of a true yield point. At temperatures of −30° C. and below, yielding is accompanied by an abrupt decrease in load. This behavior gives rise to two inflection points commonly

Fig. 3: Stress-strain curves for machine direction polyethylene film (elongation rate 0.336 in./sec.) at −30, −45, −60, and −70° C.

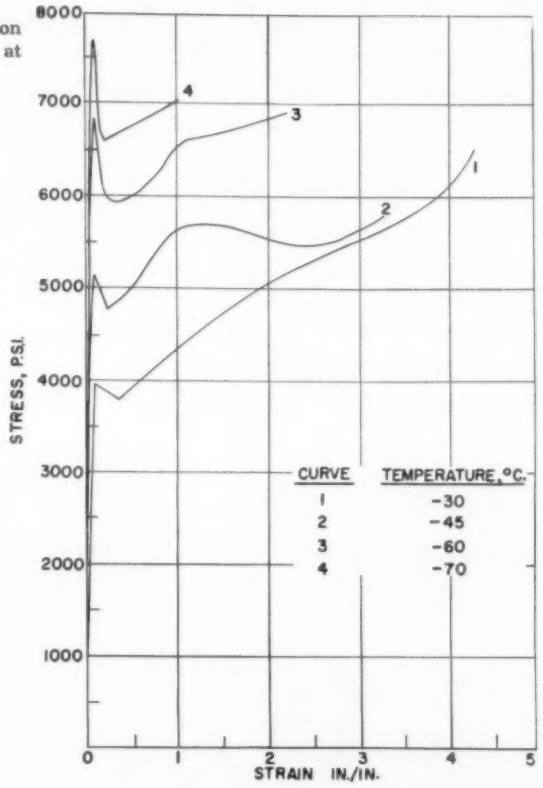

Fig. 2 (below): Stress-strain curves for machine direction polyethylene film (elongation rate 0.336 in./sec.) at 30, 15, 0, and −15° C.

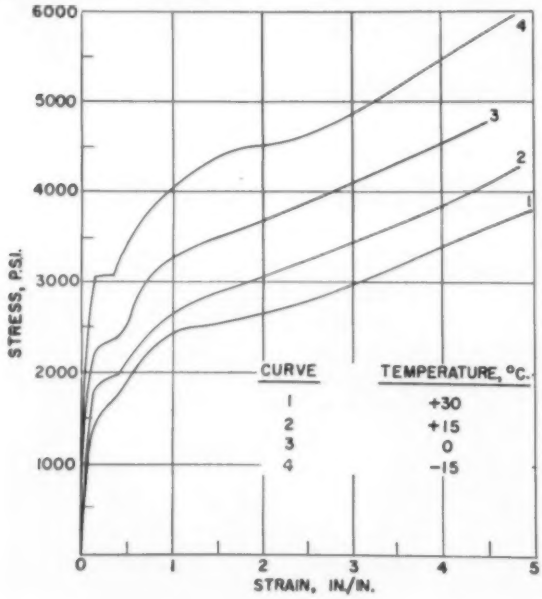

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Table I: Mechanical properties of machine direction polyethylene film

Temp.	Elongation rate	Ultimate stress	Ultimate strain	Yield point — Upper	Yield point — Lower
°C.	in./sec.	p.s.i.	in./in.	p.s.i.	p.s.i.
	0.0357	3270	5.44	1100[a]	None
+30	0.336	3870	5.09	1460[a]	None
	1.76	3340	5.80	1500[a]	None
	0.0357	4030	5.42	1600[a]	None
+15	0.336	4330	4.87	1800[a]	None
	1.76	3620	4.68	2050	None
	0.0357	4620	5.10	2440	None
0	0.336	4830	4.50	2480[a]	None
	1.76	4020	2.66	3840	3820
	0.0357	5060	4.48	3820	3340
−15	0.336	5970	4.54	3110	None
	1.76	4560	2.55	4720	4190
	0.0357	5460	4.13	3680	3220
−30	0.336	6550	4.31	4000	3750
	1.76	4720	2.77	4470	4030
	0.0357	5920	3.53	4560	3790
−45	0.336	5800	3.30	5200	4800
	1.76	5370	2.21	5770	5040
	0.0357	6560	3.63	5880	5390
−60	0.336	6930	2.23	6800	5900
	1.76	6170	0.50	8200	
	0.0357	7240	3.55	7160	6470
−70	0.336	7040	1.01	7750	6700
	1.76	7000	0.31	8690	

[a] Estimated values

called the upper and lower yield points. It is believed that the value of the upper yield point is affected greatly by the rate of elongation and the shape of the test specimen (13).

Another change in the initial portion of the stress-strain curve is increasing linearity with decreasing temperature. At lower temperatures, the contribution of viscoelastic flow to the strain becomes less pronounced. Thus, the material tends to be more Hookean in nature as the temperature is reduced.

The above experiments were repeated at two widely different elongation rates. The results of these measurements are summarized in Table I, above, along with the values obtained at the rate of 0.336 in./sec. It is apparent that the yield stress and ultimate strength increase with reduction in temperature. Exceptions to this generality occur in the temperature region of −30° C. The behavior of the film in this region will be discussed in the following section. The upper yield point at −70° C. is approximately six times greater than at +30° C and the ultimate strength is slightly more than double. Both the upper and lower yield points are influenced by the rate of elongation, rising with increasing rate. At low temperatures, the extensibility of the material is reduced markedly by high elongation rates. At −60 and −70° C., the material breaks shortly after the yield point is reached when stretched at the fastest rate. Because the load decreases once the material starts to yield, the ultimate tensile strength is, therefore, lower than the upper yield stress.

The change in stress-strain behavior of the film with temperature and elongation rate can be represented by the variation in strain energy required to produce fracture. This quantity depends upon both the ductility and strength of the film. To evaluate this energy approximately (the true fracture energy will depend on the true stress-strain characteristics), the areas under the average stress-strain curves were determined. The values obtained, expressing energy required for film rupture as in.-lb./in.^{3} of material, are plotted against the corresponding temperatures in Fig. 4, below. At the elongation rate of 0.0357 in./sec., the rupture energy rises throughout the tem-

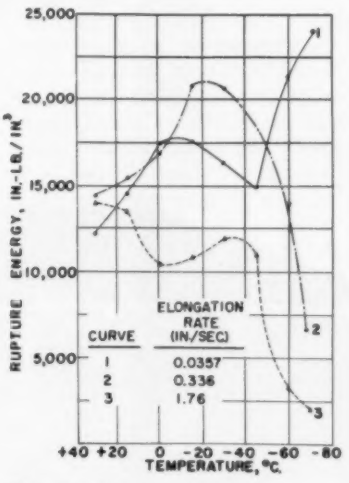

Fig. 4: Energy to rupture of machine direction polyethylene film

perature range of −45 to −70° C. This behavior can be attributed to the fact that the extensibility remains almost constant while the yield and ultimate stresses increase with reduction in temperature. The curve obtained at a rate of 0.336 in./sec. exhibits a maximum at about −20° C. The energy falls off rapidly with further decrease in temperature as the ductility of the film is reduced. Except for the room-temperature value, the rupture energy values for the 1.76 in./sec. rate lie considerably below the preceding curves, and decrease almost continually with decreasing temperature. At −60° C., increasing the elongation rate by

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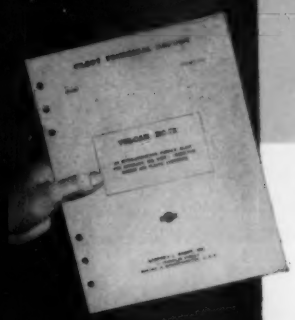

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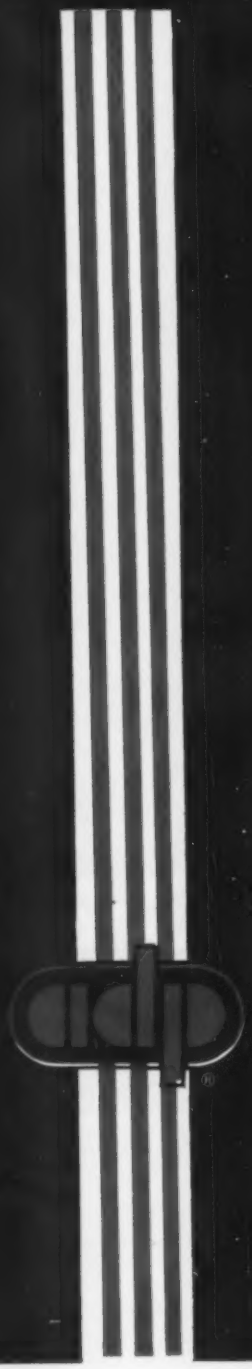

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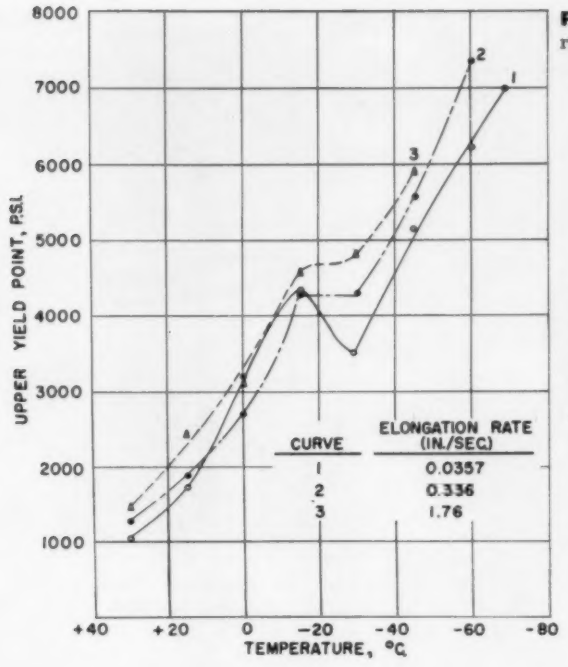

Fig. 5: Upper yield point of transverse direction polyethylene

Fig. 6 (below): Lower yield point of transverse direction polyethylene

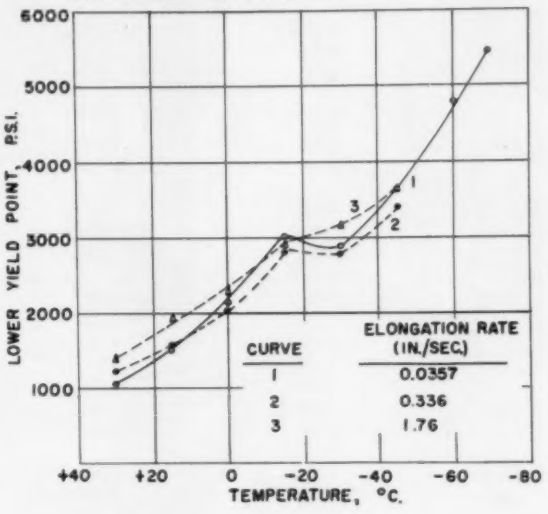

Table II: Mechanical properties of transverse direction polyethylene film

Temp.	*Elongation rate*	*Ultimate stress*	*Ultimate strain*	*Rupture energy*
°C.	in./sec.	p.s.i.	in./in.	in.-lb./in.[a]
	0.0357	3450	7.33	13,600
+30	0.336	3740	7.89	15,700
	1.76	3460	7.80	15,400
	0.0357	4480	7.06	16,000
+15	0.336	4140	7.65	17,800
	1.76	4190	7.36	18,700
	0.0357	5630	6.89	19,700
0	0.336	3940	6.61	17,000
	1.76	4480	6.72	19,600
	0.0357	6080	6.35	24,200
−15	0.336	4550	5.89[a]	18,000
	1.76	3680	5.68[a]	17,900
	0.0357	5800	6.40[a]	23,000
−30	0.336	3730	3.10[a]	9,600
	1.76	4240	4.07[a]	14,100
	0.0357	4940	5.60[a]	23,400
−45	0.336	3710	0.83[a]	3,000
	1.76	4720	2.69[a]	10,700
	0.0357	6040	4.66[a]	14,600
−60	0.336	7310	0.09	510
	1.76	7980	0.11	560
	0.0357	5940	2.31[a]	12,900
−70	0.336	7900	0.08	420
	1.76	8660	0.11	630

[a] Samples exhibit slip-plane flow.

a factor of 50 reduces the rupture energy by a factor of about one-sixth.

Transverse direction polyethylene

To obtain a more complete picture of the mechanical properties of polyethylene film, transverse direction specimens were subjected to an experimental program identical to that described for machine direction film. The data obtained from this series of measurements are presented in Table II, left, and Figs. 5 and 6, above. In general, the ultimate stress and yield point increase with decreasing temperature and the values are essentially the same as those found for machine direction film.

Exceptions to these trends and an entirely different form of flow behavior are observed at temperatures in the region of −15 to −45° C. Above this range, transverse direction material yields with a considerable reduction in width at the center of the specimen, leaving very definite shoulders at the junctions of the drawn and undrawn portions. On further stretching, the shoulders travel along the specimen as more and more of the undrawn material is narrowed to the width of

Table III: Mechanical properties of polyethylene hot-jet seals

Temp.	*Elongation rate*	*Ultimate stress*	*Ultimate strain*
°C.	in./sec.	p.s.i.	in./in.
	0.0357	2230	5.57
+30	0.336	2390	5.55
	1.76	2020	5.53
	0.0357	2710	5.34
+15	0.336	2890	5.35
	1.76	2420	4.91
	0.0357	3220	5.01
0	0.336	3550	5.10
	1.76	2760	5.30
	0.0357	4260	4.11
−15	0.336	4090	4.93
	1.76	4210	3.27
	0.0357	4160	3.90
−30	0.336	3900	2.41
	1.76	3980	0.13
	0.0357	4410	2.99
−45	0.336	5110	0.07
	1.76	4640	0.09
	0.0357	5720	0.11
−60	0.336	5970	0.07
	1.76	5650	0.07
	0.0357	7120	0.10
−70	0.336	6550	0.07
	1.76	5390	0.07

the drawn portion. This type of cold-drawing behavior has been observed for unoriented films of polyethylene and a flow mechanism has been postulated(14). In the −15 to −45° C. range, however, stressing results in the yielding of a very short length of the sample. The action is accompanied by a large reduction in the thickness of this section with only a slight change in width. As elongation is continued, yielding of short lengths of the sample proceeds in the form of two frontal waves, parallel to the width direction, which travel toward the film clamps. Definite striations appear in the yielded section of the test specimen, at right angles to the direction of stressing. Figure 7, above, is a photograph of a sample, placed between crossed Polaroids, that exhibited this flow behavior. The force trace recorded by the oscillograph during this period is saw-toothed in appearance, but the average load remains constant. Upon completion of this action over the entire length of the specimen, the material breaks with little further elongation or increase in load. Occasionally, only a portion of the sample will yield in this fashion, with rupture occurring at the edge of the frontal wave.

This change in cold-drawing behavior of transverse direction film suggests that flow is taking place by a different mechanism in this temperature range. The absence of appreciable cold-flow-induced strain-hardening, observed at higher temperatures, suggests that stressing the film produces slippage along crystal planes. The data of Table II indicate that the temperature at which this behavior occurs is rate-dependent.

The transition region is manifested also by the occurrence of inflection points in the curves of upper and lower yield points versus temperature (Figs. 5 and 6). Because of the peculiar flow behavior of the material in this

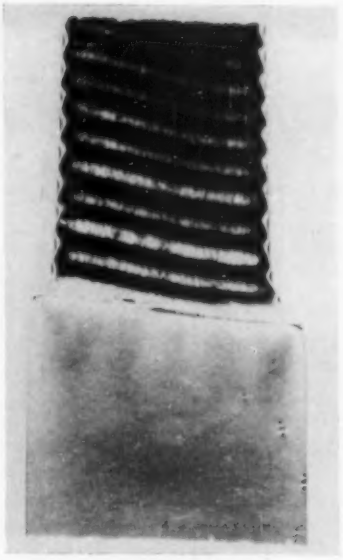

Fig. 7: Slip-plane flow along transverse direction at −30° C.

temperature range, there is a much greater differential between the upper and lower yield points than was found for machine direction film. The smaller amount of strain-hardening accompanying this type of flow results in an ultimate strength lower than the upper yield stress.

The greatest differences in properties of transverse film as compared to machine direction material are to be found in the ultimate strain and rupture energy. The dependence of these characteristics on rate of elongation is much more marked for the transverse film. At −60 and

(*To page* 222)

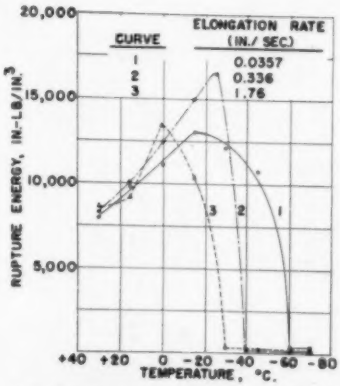

Fig. 8: Energy to rupture hot-jet seals

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Electrical properties of modified epoxy resins

*By John Delmonte**

Addition of polyethylene glycols to dodecenyl succinic anhydride-epoxy systems increases the mole ratio of the anhydride to epoxy needed for optimum properties. Dissipation factor measurements at low frequencies are especially useful in such studies.

Epoxy resins enjoy many important industrial applications as electrical insulating materials, structural bonding agents, and protective coatings. Among their outstanding virtues is their ability to combine chemically with modifying agents which enhance their properties and extend their range of usefulness. In this paper, the reaction between epoxy resin, anhydrides, and polyols is examined with particular emphasis upon polyethylene glycols of varying molecular weight. Their influence upon the electrical properties is noted inasmuch as a variety of interesting and useful industrial products are beginning to accrue from these combinations of materials.

Theory

In order to interpret the probable reactions that occur when modifying agents are added, one must examine the curing mechanisms for epoxy resins. For polyamine curing agents this involves the reaction of terminal epoxide groups with the active hydrogens of the polyamine.

The reaction mechanism with anhydrides, according to Fisch (1),[1] involves an ether linkage at the hydroxyl group contained in the commercial epoxy resins, followed by reaction of the hydrogen of the second carboxylic group formed, with the epoxide ring. In this manner, the molecules are effectively cross-linked as the cure or the polymerization takes place.

It is also noteworthy that although one may calculate the stoichiometric proportions of polyamines to cure an epoxy resin, the determination of the amount of anhydride for optimum behavior is performed empirically; it usually falls in the range of 0.6 to 1.0 moles of anhydride per epoxy mole equivalent. Consequently, it was necessary in our studies to determine by electrical and mechanical tests an optimum anhydride concentration, and then after modification with polyols, a redetermination of the optimum range.

Reaction of polyanhydride with epoxy

One of the best known and most widely used epoxy resin systems makes use of solid epoxy

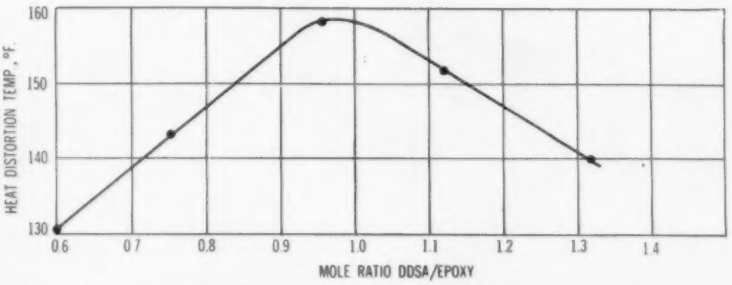


Fig. 1: Influence of DDSA/epoxy mole ratio on heat distortion temperature

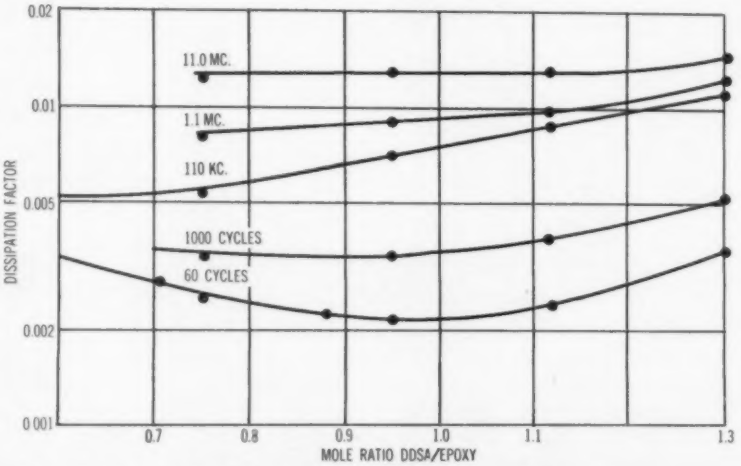
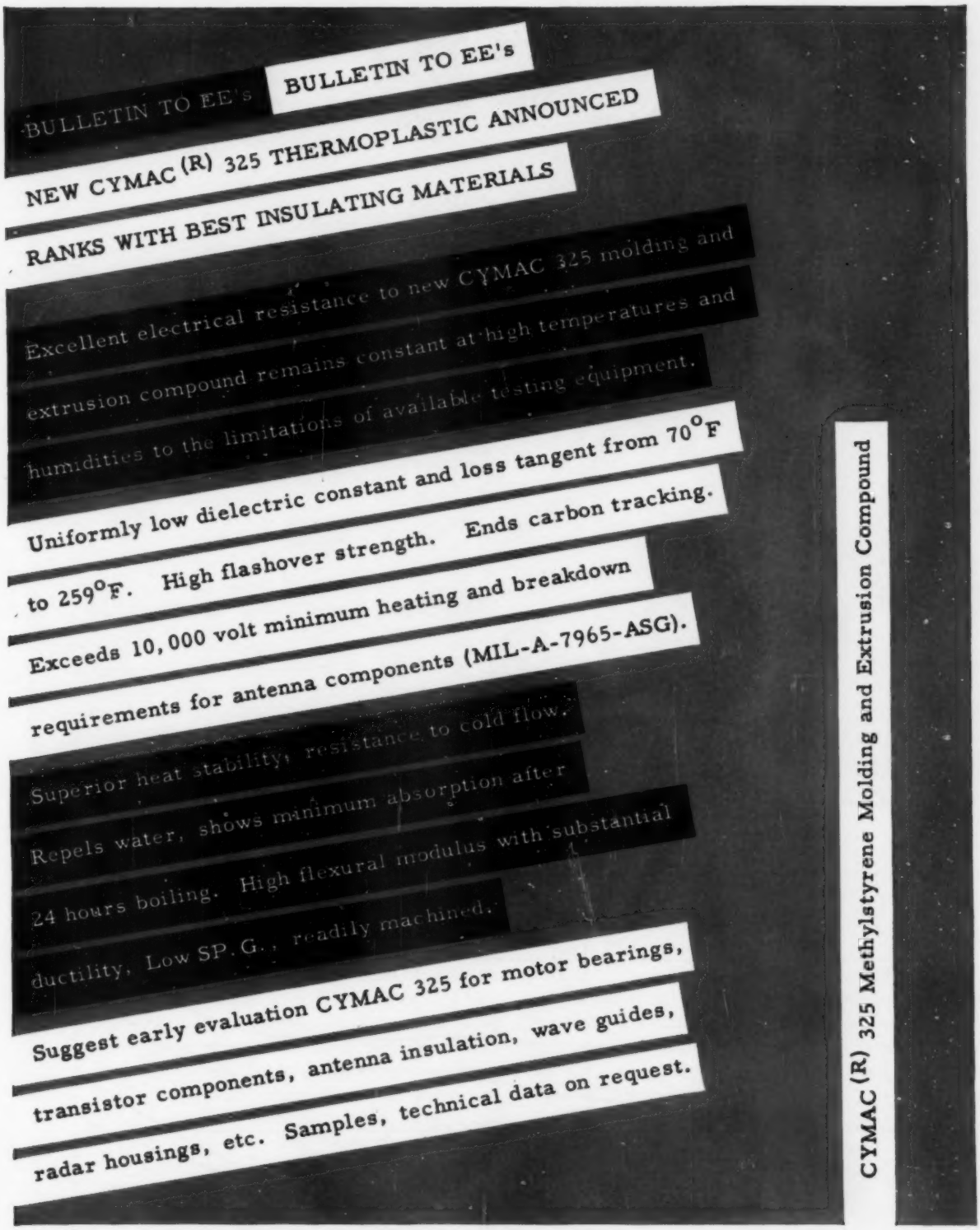


Fig. 2: Influence of DDSA/epoxy mole ratio on dissipation factor

Paper presented at the Symposium of the Plastics and High Polymer Div., International Union of Pure and Applied Chemistry, Paris, France (July 1957).
*President, Furane Plastics, Inc.
[1]Numbers in parentheses link to references at end of article, p. 229.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resin and phthalic anhydride. This system, involving high temperature cure at 150 to 170° C., has enjoyed wide commercial acceptance.

In this paper data are cited on newer liquid systems involving liquid epoxy resins of 12,000 to 20,000 cp. viscosity at 23.5° C. and 190 to 220 g. per epoxy mole equivalent, liquid anhydrides such as dodecenyl succinic anhydride (DDSA), polyethylene glycols, and special promoters. Although they are not the commercial systems or materials currently in use or under development, they will exemplify the influence which is exerted by polyols upon the properties of epoxy resins, and can serve to point the way to unexplored fields of research in epoxy chemistry.

Table I: Influence of polyethylene glycol on hardness

Mole ratio DDSA/epoxy	*Polyethylene glycol, parts per 100 of epoxy resin*	*Shore D hardness at 23° C., instantaneous and at 10 sec.*
0.75	0	85-82
1.00	0	82-80
1.12	0	83-80
1.32	0	82-78
0.75	25 P-200	61-36
1.00	25 P-200	76-69
1.12	25 P-200	79-75
0.75	25 P-400	67-52
1.00	25 P-400	76-60
1.12	25 P-400	77-72
1.32	25 P-400	78-74
1.50	25 P-400	76-72
0.75	25 P-1000	72-63
1.00	25 P-1000	76-70
1.12	25 P-1000	76-72
1.32	25 P-1000	78-73
1.50	25 P-1000	75-68
1.32	50 P-1000	66-56
1.32	75 P-1000	46-25
1.32	100 P-1000	20-12

Test samples were cast ⅛ in. thick between glass plates, covering an area roughly 10 by 6 inches. To eliminate cure variables all specimens were cured under identical conditions at 200° F. for 16 hr., followed by 2 hr. at 250° F.

Previous experiments entailing prolonged heating at 200° and 300° F. in air and out of contact with air have indicated that these cure conditions achieve full cure in a system of epoxy resin, dodecenyl succinic anhydride, and promoter.

Various experimental methods may be employed for determination of the optimum proportion of anhydride to epoxy resin, assuming that the most desirable properties appear at the optimum ratio.

A minimum loss in weight at elevated temperature suggests the optimum combining proportions(2); a minimum water absorption, a maximum heat distortion temperature, and a minimum dissipation factor at various frequencies are indicative and have

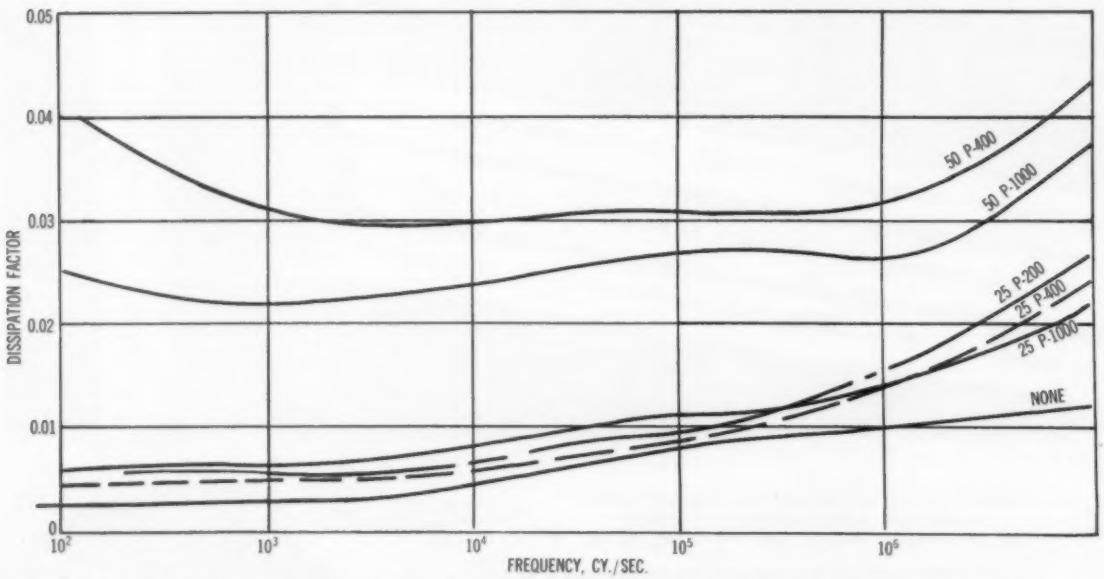
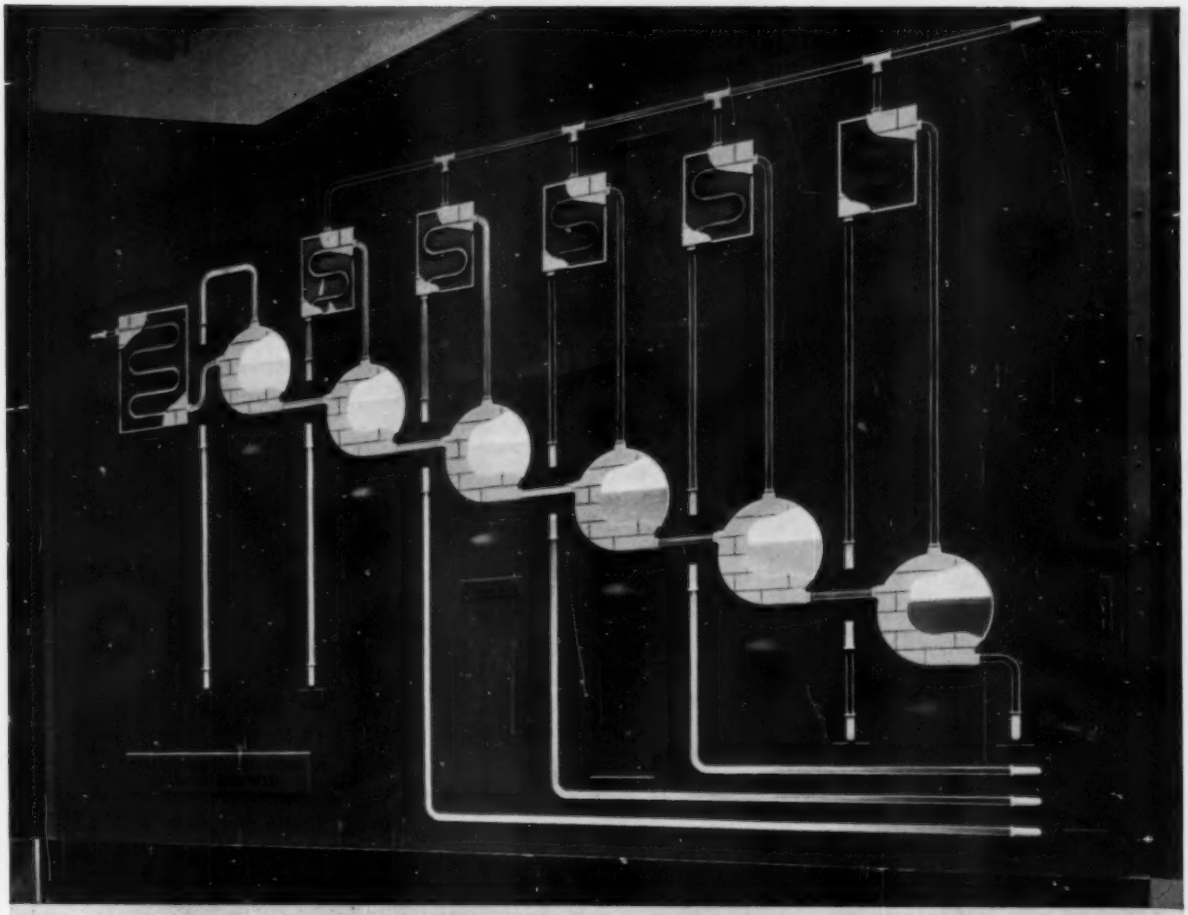


Fig. 3: Frequency versus dissipation factor for systems: 100 epoxy resin + 125 DDSA + promoter + polyethylene glycol as shown on curves. All amounts are in parts by weight



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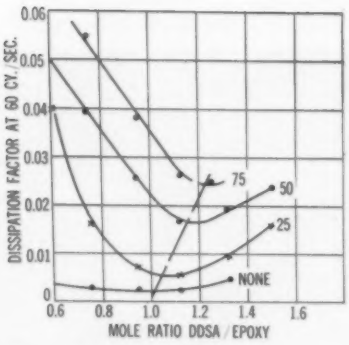

Fig. 4: Effect of P-1000 (parts per 100 epoxy resin) on optimum DDSA/epoxy mole ratio at 60 cycles

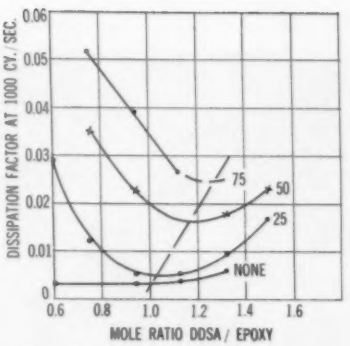

Fig. 5: Effect of P-1000 (parts per 100 epoxy resin) on optimum DDSA/epoxy mole ratio at 1 kilocycle

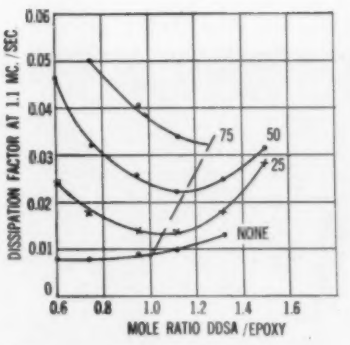

Fig. 6: Effect of P-1000 (parts per 100 epoxy resin) on optimum DDSA/epoxy mole ratio at 1.1 megacycles

a tendency to coincide at the optimum ratio.

The optimum mole ratio of dodecenyl succinic anhydride to an epoxy resin with an average equivalent weight of 200 g. per mole of epoxy appears to be 1:1 (on a weight basis 1.33 to 1.0). This is confirmed by the data in Fig. 1, p. 152, depicting the heat distortion temperature as measured by A.S.T.M. method D 648-56. Loss in weight at 400° F. indicated a slightly lower ratio of DDSA to epoxy, but not too clear a minimum. Water absorption tests showed a minimum water absorption in 24 hr. at 1:1 DDSA/epoxy ratio.

Dielectric properties for various mole ratios of DDSA to epoxy are indicated in Fig. 2, p. 152. Data were obtained for frequencies from 60 cy./sec. to 11.0 mc./sec. at 23° C. Measurements were made with a Boonton Radio Corp. Q-meter for 10^3 to 10^7 cy./sec.; with the aid of an impedance bridge and 1000-cycle oscillator at 1000 cy./sec.; and a modified Schering bridge at 60 cy./sec. It is noteworthy that the influence of mole ratio of DDSA to epoxy was apparent at only the lower frequencies, where a minimum dissipation factor was indicated at approximately 1:1 ratio.

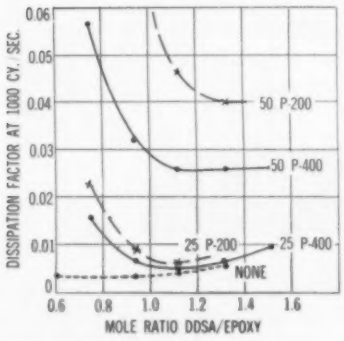

Fig. 7: Effect of P-200 and P-400 (parts per 100 epoxy resin) on optimum mole ratio of DDSA to epoxy

Effect of polyethylene glycol modifiers

Polyethylene glycols

$$[HO(CH_2{\cdot}CH_2O)_xH]$$

of various molecular weights were introduced into the DDSA/epoxy system and the influences upon dielectric properties and mechanical properties determined. Three liquid polyols were used: P-200, P-400, and P-1000. The first two are liquid polyethylene glycols and the third is a waxy solid. The numbers (200, 400, 1000) indicate average molecular weight of the polymers.

The plasticizing action of the polyethylene glycols was sufficient to render the compositions semi-rigid as indicated in Table I, p. 154.

Excessive polyethylene glycol, particularly of lower average molecular weight, may completely fluidify the DDSA/epoxy system, inhibiting the cure of the material. The softening action was sufficient to eliminate heat distortion temperature as a useful criterion. It is noteworthy that at the lower mole ratios of DDSA to epoxy, the influence of the molecular weight of the polyethylene glycol upon the hardness is more apparent. Larger amounts on a weight basis of higher molecular weight polyethylene glycol could be tolerated; on a molar basis, up to approximately 0.4 mole of a polyethylene glycol could be added per mole equivalent of epoxy cured with dodecenyl succinic anhydride.

Figure 3, p. 154, depicts the frequency spectrum of dissipation factor at 20 to 25° C. for an approximately 1:1 mole ratio of DDSA to epoxy resin and varying amounts of P-200, P-400, and P-1000. On a weight basis, the P-200 causes higher dielectric losses than the higher-molecular-weight compounds.

The optimum ratio of mole

(*To page* 229)

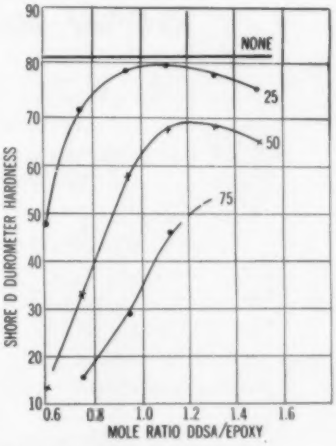

Fig. 8: Effect of P-1000 (parts per 100 epoxy resin) on optimum DDSA/epoxy mole ratio, as indicated by Shore D hardness values at 25° C.

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General

Polymerization. A. F. Roche and F. H. Bolton. Ind. Eng. Chem. *49*, 1540-47 (Sept. 1957). *Elastomers.* B. S. Garvey, Jr. Ibid. 1593-98. *Fibers.* C. S. Grove, Jr., R. S. Casey, and J. L. Vodonik. Ibid. 1599-1603. *Hard rubber.* H. Peters. Ibid. 1604-06. *Plastics.* R. B. Seymour. Ibid. 1629-38. *Protective coatings.* F. Scofield. Ibid. 1639-42. Recent developments in these fields are reviewed. Many references are cited, ranging from 40 on hard rubber to 445 on polymerization.

Materials

Heat-resistant laminate for supersonic equipment. F. W. Jahns, Jr. Elec. Mfg. *61*, 84-5 (Jan. 1958). Improved asbestos-phenolic materials have been developed to act as heat barriers with retention of strong structural characteristics. Felted asbestos-phenolic laminates have been exposed to temperatures as high as 3500° F. for several seconds and have been in continuous operation at 500° F. without breakdown of thermal and mechanical characteristics. The materials are capable of fabrication using conventional techniques and equipment.

Irradiated polyethylene insulation systems. K. J. Mackenzie and R. A. Ward. Elec. Mfg. *61*, 56-61 (Jan. 1958). Irradiated polyethylene, containing the proper stabilizers, contributes several new advantages to the outstanding properties of standard polyethylene. Among these are non-melting characteristics, excellent resistance to voltage overloads and stable electrical properties over a wide temperature range. Surface arcing resistance tests show the superiority of irradiated polyethylene as an insulator to materials such as polyvinyl chloride and standard polyethylene. The voltage endurance depends not only on the inherent nature of the material used, but also on the construction and method of application. By use of the proper techniques in applying irradiated polyethylene long endurance to voltage stress and corona resistance are obtained as a result of the ability of the material to shrink and bond itself to form a structure with fewer voids. Because of the nonmelting character of irradiated polyethylene, the encapsulation technique is especially useful.

Properties of polypropylene. Materials in Design Eng. *46*, 164, 166, 167 (Dec. 1957). A new thermoplastic resin, polypropylene, an isotactic molecule, is now in commercial production. The plastic has a melting point of 325 to 340° F. and retains dimensional shape in the unstressed condition at temperatures up to 300° F. It has a low specific gravity (0.90 to 0.91). The material has somewhat higher tensile strength and rigidity than high density polyethylene. Its electrical properties are similar to those of high density polyethylene. Polypropylene can be fabricated by all conventional techniques and potential applications are many and varied.

Polyox: high molecular weight polymers of ethylene oxide. Polymerization with alkaline earth carbonate catalysts. F. N. Hill, F. E. Bailey, and J. T. Fitzpatrick. Ind. Eng. Chem. *50*, 5-7 (Jan. 1958). Water-soluble polymers of ethylene oxide having intrinsic viscosities up to about 10 can be made at high rates by the use of alkaline earth carbonates as catalysts. The carbonates must contain a certain amount of adsorbed water and must be free of certain interfering anions, particularly nitrate.

New nylon from France. J. Fouque. Product Eng. *28*, 76-9 (Dec. 23, 1957). A new polyamide, nylon-11, which is derived from castor oil instead of petroleum or coal is described. Nylon-11 has superior stability to established nylons after prolonged exposure to water. The water absorbed after a 14-day immersion was only 1.6%, compared with 10.2% for nylon-6/6. As a result of the low water absorption the electrical properties of nylon-11 resemble those of other polyamides in the dry state. The new material is more resistant to organic acids, mineral acids, and dilute oxidizing agents, exceeding that of other nylons. The spread between the fusion and degradation temperatures is increased as a result of a lower melting point. Large precision moldings that normally require more time in the mold are now possible.

Molding and fabricating

Causes and control of calender roll plating of vinyl compounds. L. G. Howard and R. C. Hess. Plastics Tech. *3*, 887-91, 911 (Nov. 1957). Compounds of various barium-cadmium stabilizers using 2.0% epoxidized soybean oil as a part of the stabilizer-plasticizer system were used to study the calender plating of vinyl chloride plastics. Plating, in most cases, is directly proportional to the barium-cadmium concentration, and high concentrations result in increased plating. The barium-to-barium ratios, in most instances, have a direct bearing on roll plating. The higher the barium content, the greater the plating. Chelating agents (organo phosphites), when used with barium-cadmium stabilizers in conventional concentrations, have no significant effect on the degree of roll plating, although abnormally high concentrations significantly reduce roll plating. Pigments such as lead chromates and the phthal-

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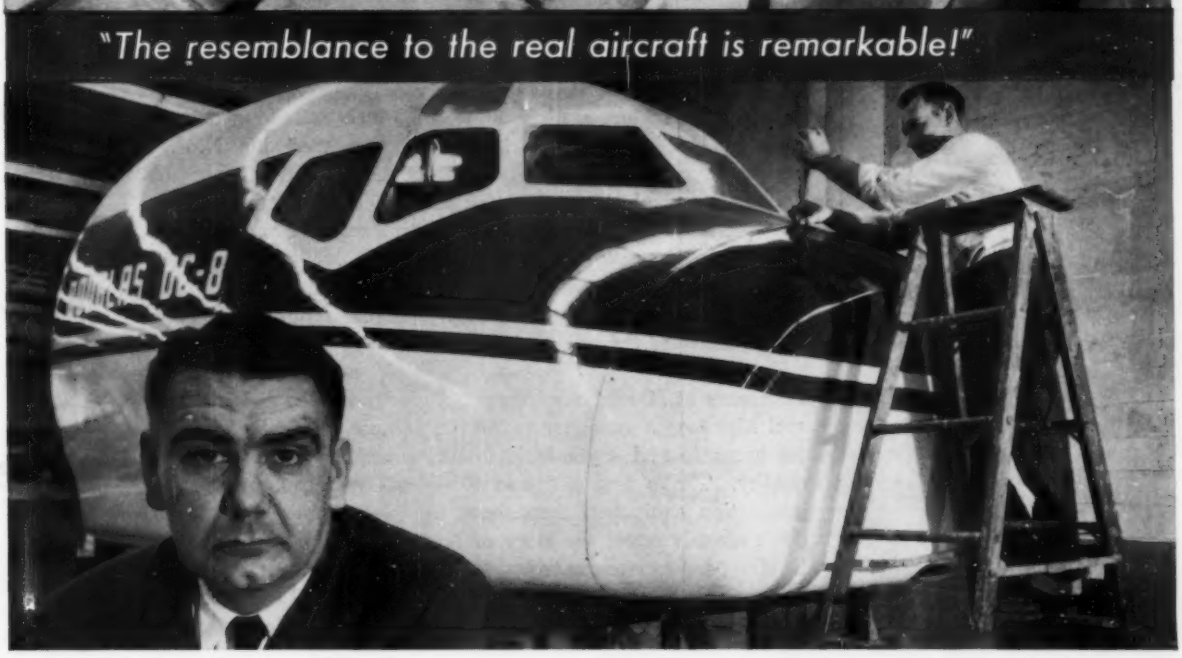

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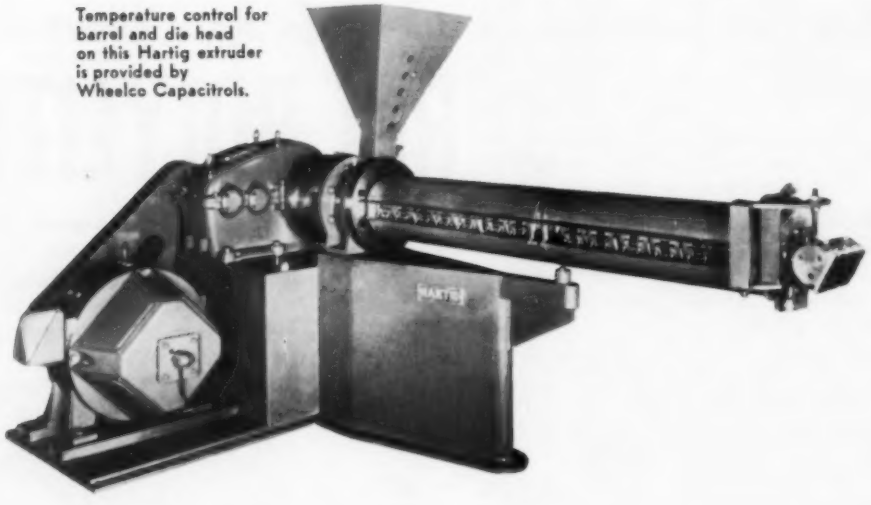
Temperature control for barrel and die head on this Hartig extruder is provided by Wheelco Capacitrols.



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ocyanines are partially soluble in the plating components and increase roll plating. The vinyl chloride resins tested did not appreciably alter the degree of plating. Fillers reduce plating because of their scrubbing action. Silene EF and hi-Sil 110 are particularly effective. Stearic acid, a lubricant, significantly reduces roll plating. As a result of the information gathered from the calender roll plating test, it now is possible to formulate compounds that are either non-plating or show reduced plating tendencies.

Applications

Transient heat flow studies aid design of reinforced plastic structures. J. L. Dietz and W. J. Hangen. Aviation Age *28*, 76-82 (Nov. 1957). Reinforced plastics are considered for use in missiles because they solve the heat problem by their low thermal conductivity. Measurements are reported at transient conditions for glass-reinforced silicone and polytetrafluoroethylene.

Plastics for building. Building Research Station Digest No. 103, 7 pp. (Oct. 1957). The uses of plastics in building construction are reviewed. These uses include roofing, lighting, external cladding, internal linings, thermal insulation, vapor barriers, piping and fittings, plumbing parts, electrical parts, hardware, and resin-bonded materials such as plywood and chipboard.

Permeability of gases and vapors through composite membranes. Permeability valves. C. E. Rogers, V. Stannett, and M. Szwarc. Ind. Eng. Chem. *49*, 1933-36 (Nov. 1957). Systems exhibiting different permeabilities for different flow directions may be used as "valves" in special applications. Such systems are described and the conditions required for their operation are discussed. Permeability of gases and vapors and the rate of gas transmission are measured through composite membranes which are composed of layers of different polymer films. Transmission of water vapor through single films is pressure-dependent. Theoretical transmission through two films in

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series was calculated from the experimental data.

Natural and accelerated weathering tests and their influence on vinyl compounds. F. Chevassus. Ind. Plastiques Mod. (Paris) *9*, No. 7, 38-42 (1957). Correlations between natural and accelerated aging tests are discussed and the main factors operative in natural aging are described. The differences between the light sources of the Weatherometer and the Fadeometer and solar radiation are emphasized. The thermal history of a material is important in its behavior on exposure to light degradative forces.

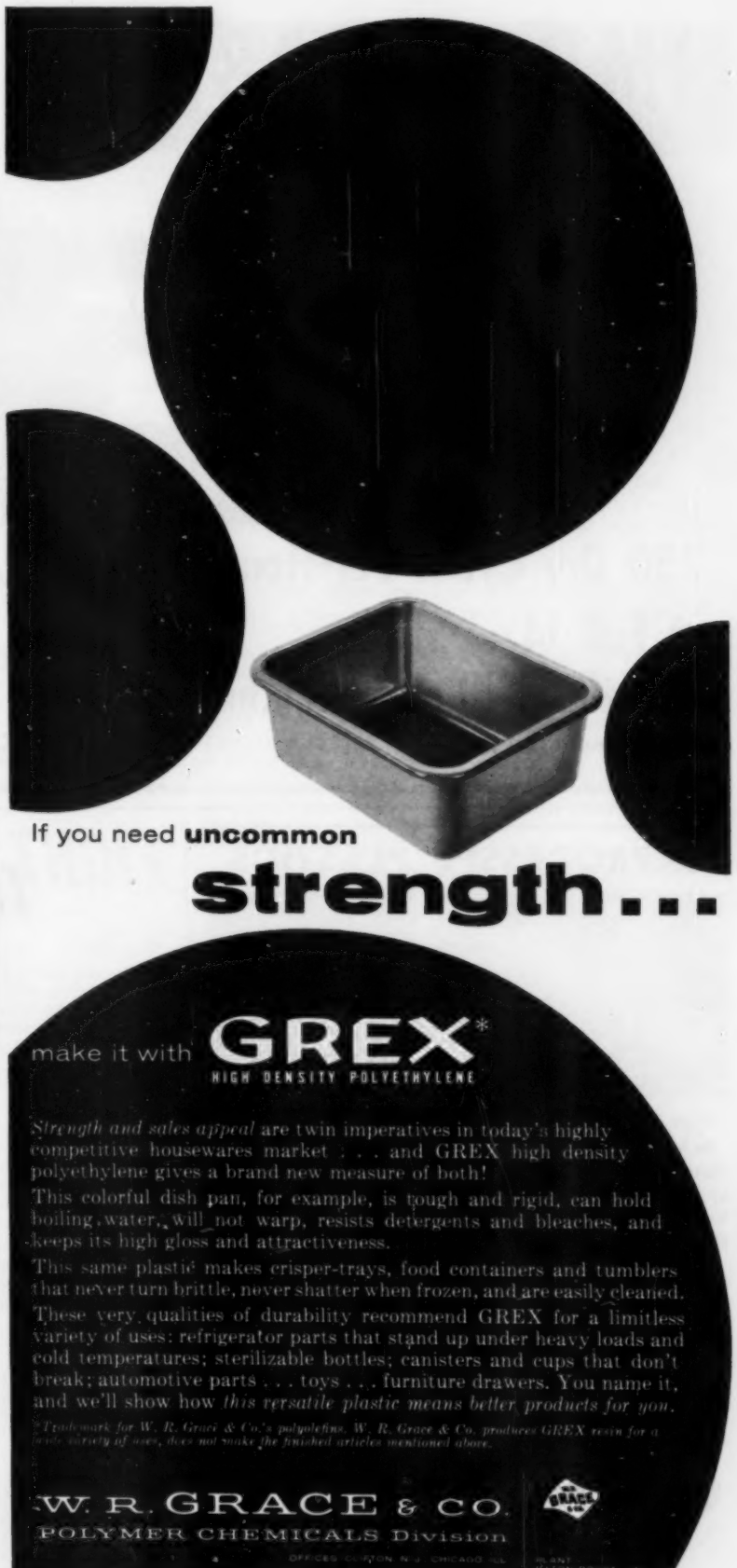
Rubber and resin-rubber soling. Rubber and Plastics Age *38*, 860 (Oct. 1957). Discusses use of rubber and resin-rubber blends in making of shoe soles.

Properties

Effect of high doses of ionizing radiations on organic high polymers. K. Little. A.E.R.E. Report GP/R-1402, 6pp (1957). Physical changes in polymers irradiated in the Harwell Reactor B.E.P.O. to fluxes of 2.5×10^{-9} nrt in air and argon are described. Orlon and a nylon-terephthalic acid copolymer retain their tensile properties better than other polymers. Polyethylene and polyamides decompose more rapidly if irradiated in air. The *p*-phenylene group in polymers retards degradation. The presence of oxygen during irradiation does not affect polyacrylonitrile.

Estimation of aging of plastic by means of impact tests. W. Späth. Gummi u Asbest *10*, 394-96 (1957). The manner in which aging affects the break load and break deformation of a plastic determines the classification into one of four types for which theoretical graphs have been drawn. For glass-fiber-reinforced resins changes in the break load are compensated by opposite changes in break deformation. For epoxy resins the break load is constant and the break formation fluctuates.

Properties of plastic films. Materials in Design Eng. *46*, 149, 151, 153 (Dec. 1957). The general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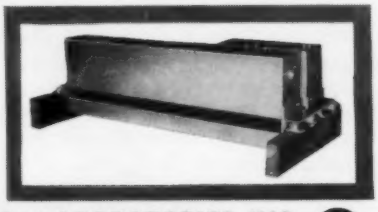

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properties, physical properties, resistance to chemicals and permanence of 18 plastic films are catalogued in a Materials Data Sheet.

High-speed tensile tests of thermoplastics. R. E. Ely. Plastics Tech. 3, 900-03, 910 (Nov. 1957). A high-speed tensile machine and a standard Instron machine were used to fracture cellulose acetate butyrate and polymethyl methacrylate tensile specimens in periods ranging from 1½ milliseconds to 15 minutes. The operating principle of this pneumatically-operated, high-speed machine is described. The mechanical properties for polymethyl methacrylate are reported for strain from 0.003-1100 in./in./min., and for cellulose acetate butyrate for strain rates from 0.02 to over 5000 in./in./min. Load-time measurements for the two materials were obtained by means of electronic equipment, while strain data were reduced from motion picture records.

On the necessity of fundamental and widened research in strength of materials. M. V. Zaustin. ASTM Bulletin No. *226*, 52-61 (Dec. 1957). In the not too distant past, when factors of safety were quite large and the principal engineering material was steel, ordinary test data, such as nominal results of tension tests and a few other properties, were sufficient for satisfactory design. This situation has rapidly changed and a modern design engineer needs more refined, more accurate, and more specific data than ever before. The fields in which more work is needed are nonuniform stress tension, compression, torsion, shear, stress concentration, impact, fatigue, ductility, effects of elevated temperatures, effects of low temperatures, thermal properties, complete stress-strain curves, true stress-strain curves and probability distribution in strength properties.

Testing

Constant head rate testing machine with instantaneous speed change. M. J. Manjoine, E. T. Wessel, and W. H. Pryle. ASTM Bulletin No. *226*, 31-5 (Dec. 1957),

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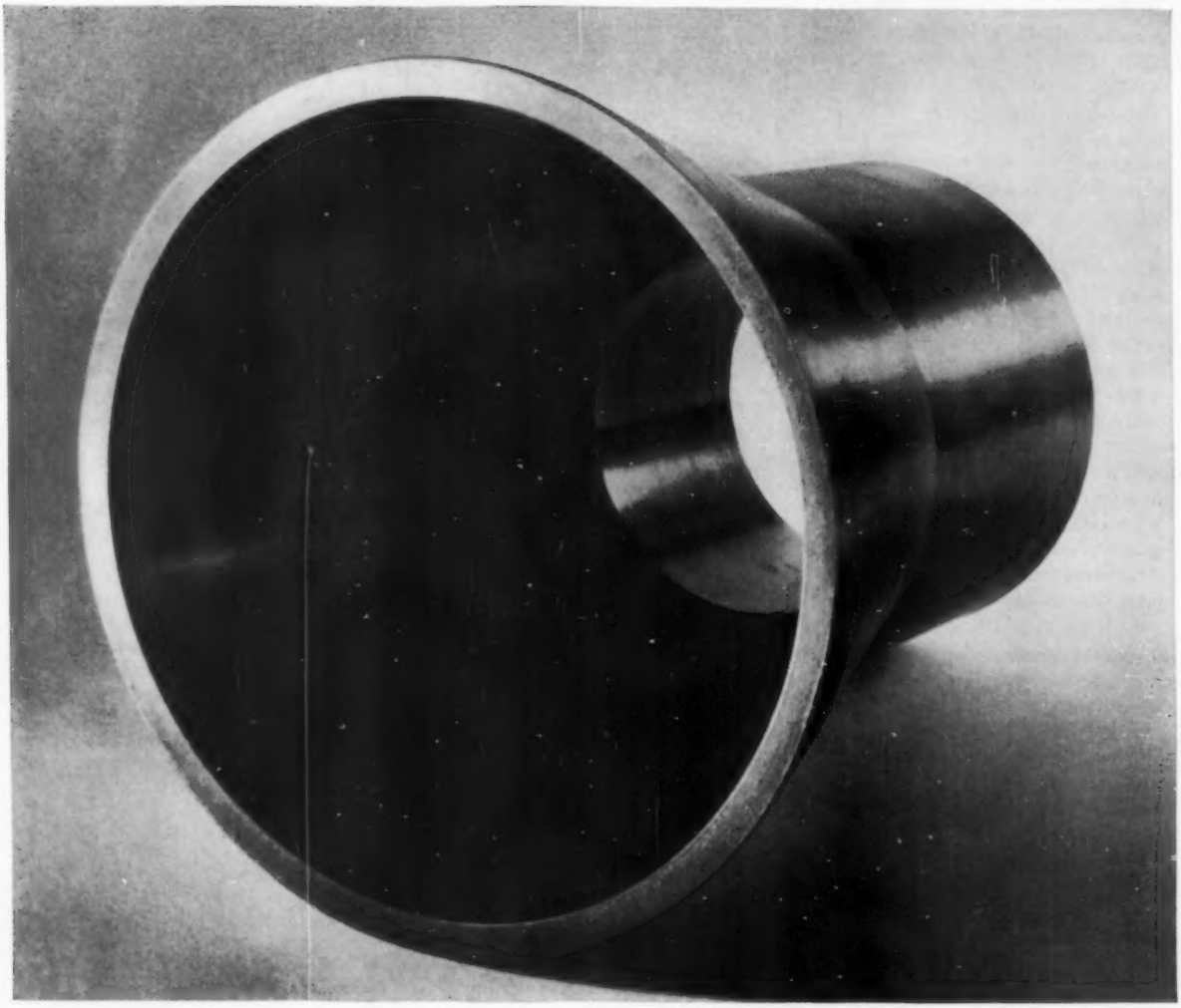

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Chemistry

Controlled boron trifluoride catalysis of epoxy polymerizations. H. B. Wagner. J. Polymer Sci. *26*, 329-32 (Dec. 1957). A new technique which permits the use of boron-trifluoride for catalysis of epoxy polymerizations is described. The destructive exotherm that ordinarily accompanies contact of this substance with epoxy compounds is avoided by gradual release of the catalyst. This controlled release is accomplished through use of the catalyst in the form of the liquid boron trifluoride-ethyl ether complex absorbed on a particulate carrier, the component particles being coated with a paraffin barrier layer. Employing this catalyst system a smooth but rapid reaction is obtained starting with all reactants initially at room temperature and without application of external heat. Polymerization is essentially complete within several minutes following addition of the catalyst system.

Publishers' addresses

AERE Report: Atomic Energy Research Establishment, Harwell, Berks., England.

ASTM Bulletins: American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

Aviation Age: Conover-Mast Publications, 205 E. 42nd St., New York 17, N. Y.

Building Research Station Digest: Her Majesty's Stationery Office, London, England.

Design Engineering: 481 University Ave., Toronto, Ont., Canada.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.

Gummi und Asbest: A. W. Gentner Verlag, Forststr. 131, Postfach 688, Stuttgart 14a, Germany.

Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Industrie des Plastiques Modernes: Rue du Colisee, Paris 8, France.

Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Plastics Technology: Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.

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U.S. Plastics Patents

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Polymers. W. A. Reeves, C. Hamalainen, and J. D. Guthrie (to United States). U. S. 2,814,573, Nov. 26. Polymers containing nitrile methylolphosphorus and bromine groups.

Resins. A. Mitchell, 3rd (to Du Pont). U. S. 2,814,600, Nov. 26. Cellular resins from arylene diisocyanates and polysulfide polymers.

Polymers. G. K. Storin, F. E. Lawlor, and F. Casciani (to Hooker). U. S. 2,814,602, Nov. 26. Vinyl polymers plasticized with alkoxychlorobenzenes.

Elastomers. R. F. Nichols and R. O. Weisz (to B. F. Goodrich). U. S. 2,814,604, Nov. 26. Diisocyanate-linked elastomers.

Building. L. E. Sogaro. U. S. 2,816,329, Dec. 17. Plastic building.

Expanded plastics. O. Shuffman (to Hudson Foam Plastics). U. S. 2,816,741, Dec. 17. Apparatus for mixing components of a foaming composition.

Foam plastics. M. H. Roth (to Monsanto). U. S. 2,816,827, Dec. 17. Styrene particles including foaming agents.

Molding compositions. J. A. Yourtee (to American Viscose). U. S. 2,816,872, Dec. 17. Molding compositions containing cellulosic filler.

Resins. A. F. Schmutzler (to American Cyanamid). U. S. 2,816,874, Dec. 17. Composition of acid adducts and aminoplast resins dissolved in glycols.

Polyamides. A. B. Beindorff (to Chemstrand). U. S. 2,816,875, Dec. 17. Linear polyamides.

Resins. L. M. Higashi (to Monsanto). U. S. 2,816,876, Dec. 17. Phenolic resins stabilized with triaryl phosphates.

Vinyl esters. A. F. Price (to Shawinigan). U. S. 2,816,877, Dec. 17. Vinyl ester copolymer granules.

Polyureas. E. L. Wittbecker (to Du Pont). U. S. 2,816,879, Dec. 17. Spinnable polyureas.

Resins. L. A. Lundberg (to American Cyanamid). U. S. 2,819,247, Jan. 7. Flame-resistant polyester resins.

Resins. G. S. Casebolt (to American Cyanamid). U. S. 2,819,248, Jan. 7. Room-temperature-setting polyester resins.

Phenolic resins. G. K. Cleek and A. Sadle (to Allied Chemical). U. S. 2,819,251, Jan. 7. Phenolic resins concentrates.

Acrolein. E. C. Shokal (to Shell). U. S. 2,819,252, Jan. 7. Polymerization of acrolein.

Polymerization. F. Kagan (to Standard Oil). U. S. 2,819,257, Jan. 7. Ethylene polymerization.

Plastics. H. Long and J. W. Tamblyn (to Eastman Kodak). U. S. 2,819,978, Jan. 14. Stabilized cellulose ester plastics.

Films. R. E. Schornstheimer and H. P. Campbell (to Goodrich). U. S. 2,819,981, Jan. 14. Flexible vapor-permeable vinyl films.

Copolymer. H. K. Nason (to Monsanto). U. S. 2,820,018, Jan. 14. Butadiene-acrylonitrile composition.

Resins. B. R. Franko-Filipasic (to Pittsburgh Plate Glass). U. S. 2,820,021, Jan. 14. Resins comprising tetraallylamides of dicarboxylic acids.

Resins. R. W. Martin (to Shell). U. S. 2,820,022, Jan. 14. Resins from Mannich bases of alicyclic ketones.

Polymers. C. E. Schildknecht (to Air Reduction). U. S. 2,820,025, Jan. 14. Homopolymers from 2,2,2-trifluoroethyl vinyl ether.

Polymers. H. J. Passino, A. L. Dittman, and J. M. Wrightson (to Minnesota Mining). U. S. 2,820,026, Jan. 14. Fluorine-containing polymers.

Polymerization. W. E. Hanford (to Minnesota Mining). U. S. 2,820,027, Jan. 14. Polymerization of trifluorochloroethylene.

Polymerization. H. Wenning (to Huls). U. S. 2,820,028, Jan. 14. Polymerization of vinyl halides.

Cellulose ethers. W. M. Branan (to Du Pont). U. S. 2,816,889, Dec. 17. High gel carboxyalkylated cellulose ethers.

Interpolymers. M. Baer (to Monsanto). U. S. 2,816,890, Dec. 17. Interpolymers of monovinyl aromatic compounds.

Extruder. R. T. Fields (to Du Pont). U. S. 2,817,113, Dec. 24. Extruder for polytetrafluoroethylene tubes.

Film. D. R. Erickson. U. S. 2,817,114, Dec. 24. Hydroxy alkyl cellulose film.

Stretching. G. B. Shields and R. D. Stepp (to Pittsburgh Plate Glass). U. S. 2,817,117, Dec. 24. Stretching plastic interlayers.

Resins. G. Connos (to Monsanto) U. S. 2,817,386, Dec. 24. Plasticized nuclear alkylphenol-formaldehyde resins.

Wool. C. E. Pardo, Jr. (to U. S.). U. S. 2,817,602, Dec. 24. Shrinkproofing wool with epoxy resins.

Melamine. G. L. Fraser (to Monsanto). U. S. 2,817,614, Dec. 24. Internally plasticized melamine resins.

Structural unit. D. K. Bickel and S. J. Mittl (to Glidden). U. S. 2,817,619, Dec. 24. Polyester-faced structural bodies.

Lacquer. W. Altner (to Farbenfabriken Bayer). U. S. 2,817,643, Dec. 24. Mixed polyurethane lacquer.

Polyepoxides. E. C. Shokal and H. A. Newey (to Shell). U. S. 2,817,644, Dec. 24. Curing polyepoxides.

Resins. C. A. Weisberger (to Hercules). U. S. 2,817,645, Dec. 24. Reaction of polyvinylphthalimides with alkylene polyamines.

Polyelectrolytes. L. L. Contois, Jr. (to Monsanto). U. S. 2,817,649, Dec. 24. Cationic polyelectrolytes.

Copolymers. M. W. Duke (to Dow). U. S. 2,817,650, Dec. 24. Raising the melting point of acetone-soluble copolymers.

Copolymers. E. C. Chapin and R. F. Smith (to Monsanto). U. S. 2,817,651, Dec. 24. Solvent-soluble copolymers of an unsaturated alcohol and an acrylic ester.

Polymers. E. L. Cole and W. E. Skelton (to Texas). U. S. 2,817,653, Dec. 24. Sulfur-containing polymers.

Sheets. H. D. Anspon (to General Aniline). U. S. 2,817,878, Dec. 31. Sheets of polyalpha-chloroacrylate.

Resins. J. C. H. Hwa (to Rohm & Haas). U. S. 2,818,395, Dec. 31. Cation

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hourly plasticizing capacity lbs.	6.6	12	15.4	28.6	26.4	53	39.6

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model	NB 220 E	NB 360/520 E	R 01	R 02	R 6 FA	R 12 FA	R 20 FA
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hourly plasticizing capacity lbs.	75	97	7.7	7.7	29	53	75

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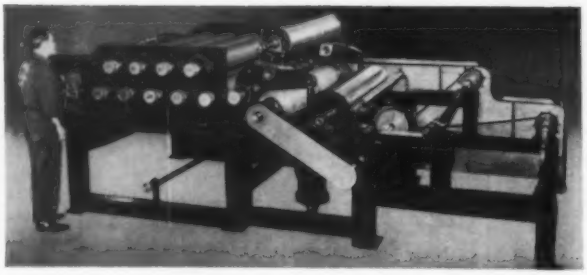

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exchange resins from vinyl thiocyanate.

Resin compositions. E. P. Wenzelberger (to Commonwealth Engineering). U. S. 2,818,396, Dec. 31. Dextran and drying oil—modified polyesters.

Resins. D. Cleverdon (to Distillers). U. S. 2,818,398, Dec. 31. Compositions of an acrylonitrile polymer and an etherated phenol condensate.

Resins. E. K. Drechsel and W. S. Forster (to American Cyanamid). U. S. 2,818,399-400-1, Dec. 31. Ethylenically unsaturated alkyd resin copolymerized with N-vinyl-2-oxazolidone.

Polyurethanes. F. B. Hill, Jr. (to Du Pont). U. S. 2,818,404, Dec. 31. Curing polyurethanes with a di-(isocyanatoaryl) urea.

Filter. J. T. Rivers, Jr. (to Du Pont). U. S. 2,818,868, Jan. 7. Polyethylene terephthalate tobacco smoke filter.

Foams. J. H. Fortune (to American Cyanamid). U. S. 2,819,231, Jan. 7. Polyethylene foams.

Cellular resin. J. H. Fortune (to American Cyanamid). U. S. 2,819,232, Jan. 7. Dithiophosphate cellular coating.

Surfactants. A. M. Schiller (to American Cyanamid). U. S. 2,816,882, Dec. 17. Polymeric surface active agents.

Polyethylene. A. W. Larchar and D. C. Pease (to Du Pont). U. S. 2,816,883, Dec. 17. Linear polyethylene and process for polymerizing ethylene.

Resin. L. M. Shorr (to Dow Corning). U. S. 2,819,245, Jan. 7. Siloxane-epoxide resin reaction products.

Molding compositions. R. Lindenfelser, M. K. Layman, and M. K. Kilthan (to American Cyanamid). U. S. 2,819,246, Jan. 7. Molding compositions of benzoguanamine-formaldehyde and butadiene-acrylonitrile.

Epoxide resins. E. L. Smith and R. Hall (to Phelps Dodge). U. S. 2,819,233, Jan. 7. Curing epoxide resin with a chelate.

Resin. M. De Groote (to Petrolite). U. S. 2,819,240-1-2, Jan. 7. Reaction products of carboxylated and amine-modified phenolic resins.

Compositions. M. T. Harvey and P. L. Rosamilia (to Harvel). U. S. 2,819,244, Jan. 7. Compositions of acetone-formaldehyde and liquid polysulfide polymers.

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Books & Booklets

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"Epoxy Resins"

By Henry Lee and Kris Neville

Published in 1957 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. 305 pages. Price: $8.00

The subtitle, "Their applications and technology," well describes the contents of this book on epoxies. The opening chapters deal clearly with the chemistry of the epoxy resins and curing agents therefore, and the chemistry is closely connected with the characteristics of the resulting resins. Chapter 6 deals with diluents, fillers, and modifiers, and subsequent chapters cover plasticizers and flexibilizers; casting, potting, and foams; adhesives; laminates; coatings; handling and safety. The more important references in the field are included. There are many tables and graphs, much useful information on practical aspects—recipes, techniques of application, etc. In the chapter on laminates, no mention is made of directionally selective reinforcement, which has been most successful with the epoxies. But this is a small fault in a work which combines thorough coverage with an excellent balance between fundamentals and practical details.

"Plastic Sheet Forming"

By Robert L. Butzko

Published in 1958 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 181 pages. Price: $4.50

Number 4 in the Reinhold Plastics Application Series, this little volume fills a definite need for a practical book on sheet thermoforming. Chapters deal with applications, forming methods, material selection, molds and mold design, commercial machinery, auxiliary equipment, decorating, production costs, and future prospects. The chapter on methods covers all but the airslip technique and the combination of airslip and plug assist, which have opened up many new applications. In the chapter on commercial machinery, no mention is made of one of the leaders in the field, nor is there any list of commercial machine makers. The chapter on decorating contains good suggestions for distortion printing. A chapter on designing products to be made by sheet thermoforming would have been desirable.

"1957 Supplement to Book of ASTM Standards (Including Tentatives). Part 6"

Published in 1957 by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 424 pages. Price: $4.00

Containing over 70 standards, this supplement, which deals with rubber, plastics, electrical insulation, includes standards, tentatives, and tests covering strength; hardness; thermal; optical; and permanence properties; analytical methods; specifications; molds and molding processes; definitions; and nomenclature.

Epoxy resin. Physical properties and characteristics, preparing of mold surface, mixing, and pouring of Epoxical, a liquid epoxy that will cure at room temperature and is designed for casting or surface-coating applications. IGL Bulletin 400 (Plastic tooling resin), 8 pages. IGL Bulletin 401 (Metallic casting resin), 4 pages. *Industrial Sales Div., U. S. Gypsum Co., 300 W. Adams St., Chicago 6, Ill.*

Sandwich core. "Mechanical Properties of 422-J Bacfoam Core for Sandwich Construction" reports tests on sandwiches with a foamed-in-place epoxy-phenolic resin core (Boeing 422-J Bacfoam type IA) which were subjected to edgewise compression and flexure tests to determine their suitability for aircraft construction. Price: 50 cents. Report PB 131077. 16 pages. *OTS, U. S. Department of Commerce, Washington 25, D. C.*

Waxes and emulsifying agents. Technical information on such applications as anti-tack and slip-producing lubricants for plastics, ingredients of sizes for paper coating, improvers of gloss and hardness in printing inks, and extenders of temperature plasticity in sealing compositions. Series 3. 10 pages. *Abril Corp., Ltd., Bridgend, Glamorgan, England.*

Skylights. Design and technical data about Marcolite reinforced plastics - in - aluminum - frame panels. 12 pages. *The Marco Co., 45 Greenwood Ave., E. Orange, N. J.*

Cutters. Descriptions, advantages, and speeds of Wink cutters for cutting extruded material without distortion. Bulletin 101. 4 pages. *F. J. Fink & Co., 221 Cherry St., Chardon, Ohio.*

Color pastes for epoxies. Data on color range and prices. Bulletin 290. 1 page. *Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, L. I., N. Y.*

Vinyl inks. "A Complete System of Gravure Inks for Multicolor Printing of Vinyl" points out lightfastness, soapfastness, general properties, uses, etc. of VC series of gravure inks. Bulletin 510. 5 pages. *Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, L. I.. N. Y.*

Gages. Details and photographs concerning absolute manometer, thermal and ionization gages, and combination thermalionization gages. Bulletin 9-1. 28 pages. *Consolidated Electrodynamics Corp., 1775 Mt. Read Blvd., Rochester 3, N. Y.*

Triplematic pumps. Data on an automatic mixing, metering, and dispensing unit for 2-part resin

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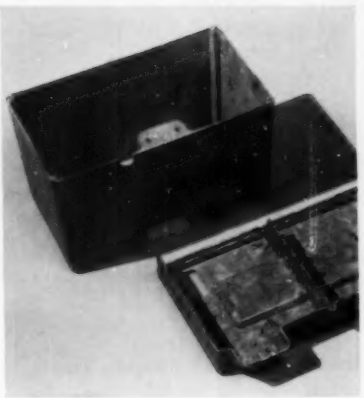
High-impact phenolic | **Automatic molding**
Phenolic for appliances



Flying saucer?

This plastic housing helps airmen find out what's cooking on the roof of the world.

It's part of a radiosonde, a device that has sparked many flying-saucer reports.

Dropped from a high-flying weather reconnaissance plane over an ocean or arctic ice, the radiosonde flips its plastic lid, releasing a parachute.

The ballooning chute yanks an antenna line out of the case. Then, as the device drifts groundward, it broadcasts a code report on air temperature, pressure, and humidity every six seconds.

Picked up by radio men, these signals enable the Air Force to piece together accurate forecasts of flying weather over remote frontiers.

The snap-off housing is molded of *Durez 16771 Natural*, selected for its impact strength and its ability to stand extremes of temperature and humidity.

In sharp contrast to the mass production of phenolic parts, this use of Durez suggests its ability to meet *your* out-of-the-ordinary requirements.

If you'd like technical data on 16771 Natural, check the coupon. For information on other special-purpose phenolics, write us, outlining the problem.

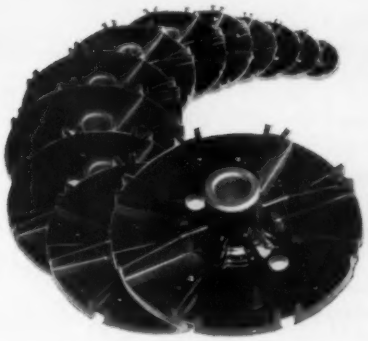
Big job, big saving

What's hot in phenolics? *Automation.*

Automatic molding of a 4¾-inch diameter water-pump impeller for new Ford cars, trucks, and tractors has made possible a switch from cast iron to phenolic —with substantial reductions in weight, production time, and cost.

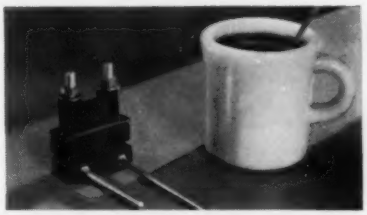
The impellers are molded 12 at a shot on the largest capacity compression molding press ever to operate on fully automatic cycle.

The material selected for the impeller is a Durez phenolic impervious to antifreeze and antirust solutions, combining moisture resistance with dimensional stability in high degree.



Thinking big? You'll find there are many ways in which mass-production molding and Durez phenolics can team up profitably for you. The versatility and exceptional batch-to-batch uniformity of these compounds assure best possible results on highly automated production lines.

Ask your molder or your Durez sales representative to suggest how you can put these advantages to work in your products.



Durez and the coffee-break

Appliance makers can tell you that wherever coffee perks, bubbles, or pours into a cup, there's likely to be a Durez phenolic close by.

Electrical components, handles, knobs —these are just a few essentials of a coffee-break, in which Durez molding compounds play an unassuming part.

A prime requisite for this sort of assignment is the ability of phenolic to resist coffee stains and chemical deterioration. The appliance designer also looks for:

- excellent surface finish
- good dimensional stability
- coolness to the touch
- crack resistance when molded around large inserts

If *you're* looking for properties like these, you can find them all in *Durez 791 Black*. They're exemplified in the component shown here, an electrode assembly for a king-sized coffee maker and dispenser.

For more facts on versatile 791 Black, check the coupon.

For more information on the Durez materials mentioned above, check here:

- ☐ High-impact Durez 16771 Natural—data sheet
- ☐ Phenolic molding compounds—descriptive bulletin
- ☐ General-purpose Durez 791 Black—data sheet

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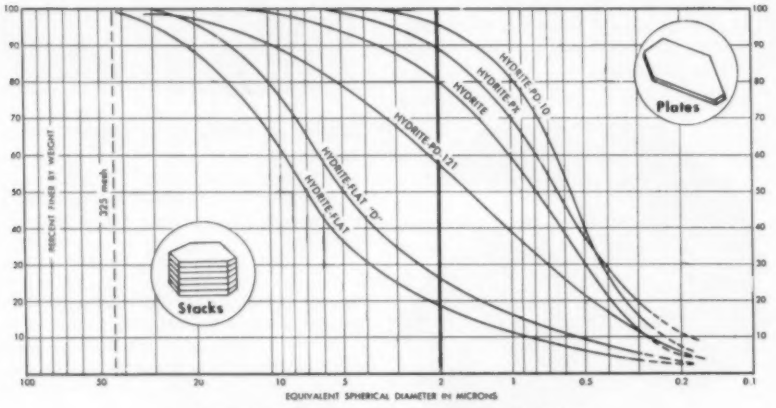

Particle Size Analysis of Various Hydrite Kaolinites.

When smaller than 2 microns, most of the kaolinite particles exist as thin, flat, hexagonal plates. When larger than this they generally exist as stacks of these plates so firmly bound together by natural forces that they act as a single particle. By the selection of the proper Hydrite Kaolinite, a controlled ratio of plates and stacks is available which will give optimum properties in a given plastics formulation.

Electronmicrograph of Kaolinite Plates.

Electronmicrograph of Kaolinite Stacks (Side View).

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systems. Includes also a partial list of solvents, adhesives, and other compounds made by the firm. 4 pages. *H. V. Hardman Co., Inc., 571 Cortlandt St., Belleville 9, N. J.*

Cyclohexanol. Grades; physical, chemical, and physiological properties; and availability of Naxol cyclohexanol, a solvent for rosin, metallic soaps, certain dyes, fats, oils, waxes, and other substances. Technical Bulletin I-20. 32 pages. *National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Epoxy adhesive. Uses, curing cycles, sizes, shapes, and typical applications of Epoxweld 100, single-component epoxy preform used in automatic or high production joining of metals, plastics, ceramics, and glasses. Bulletin 114. 2 pages. *Technion Design & Mfg. Co., Inc., 262-72 Mott St., New York 12, N. Y.*

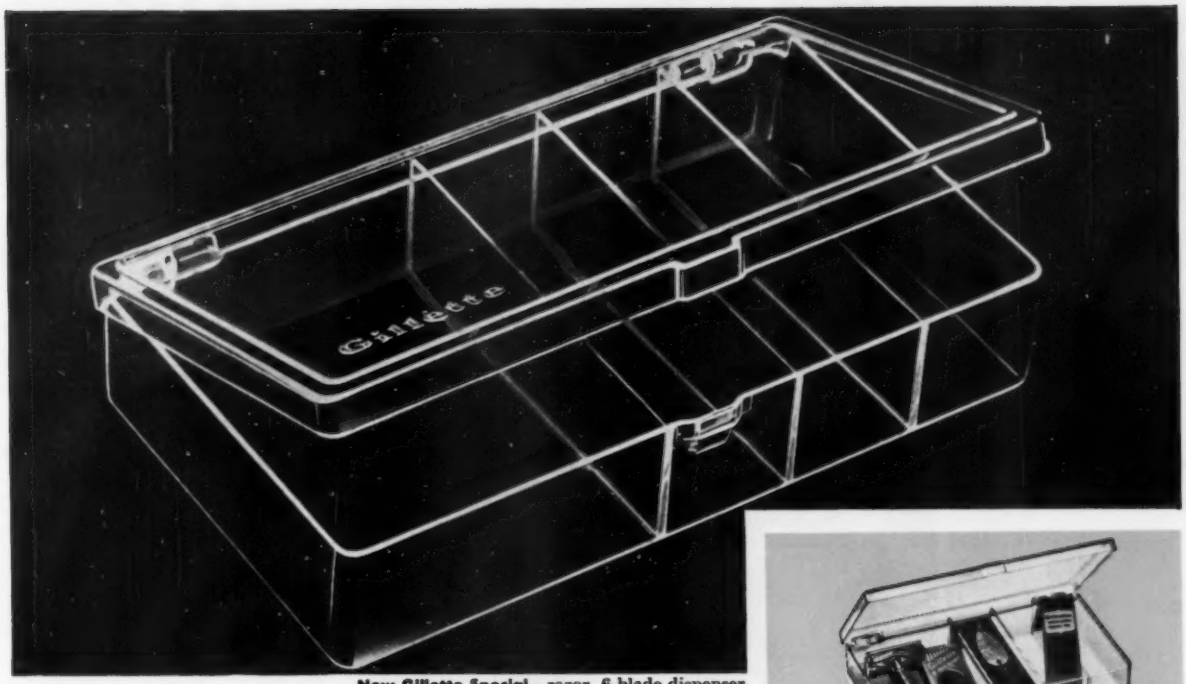
Inks. Uses, advantages, colors, prices, etc. for an ink system for gravure printing on treated polyethylene. 2 pages. *Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, L. I., N. Y.*

Conveyors. "How to Plan and Install Your Own Conveying System." Step-by-step guide in selection, installation, and operation of power belt and gravity conveyors in plastics processing and other plants. Bulletin 500. 20 pages. *Conveyor Dept., A. B. Farquhar Div., The Oliver Corp., 150 N. Duke St., York, Pa.*

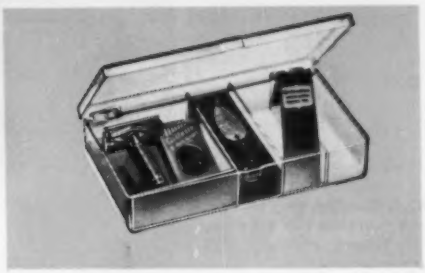
Polyethylene. Describes dozens of ways polyethylene is being used in packaging and merchandising. 16 pages. *Bakelite Co., 420 Lexington Ave., New York 17, N. Y.*

Machines for vinyl. Facilities and growth of this maker of vinyl processing machinery. 16 pages. *Lembo Machine Works, Inc., 246 E. 17th St., Paterson 4, N. J.*

Acrylate storage. Inhibition and storage of ethyl and methyl acrylate, including use of inhibitors in delaying polymerization, temper-



New Gillette Special—razor, 6-blade dispenser and gold-plated lure packed in a plastic box fishermen and handymen will find useful.



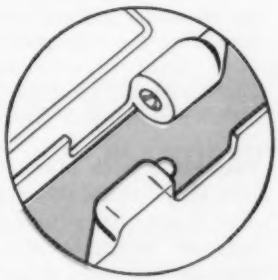
A Bright new idea in gift packaging by Gillette —custom molded by Sylvania

Chances are you're one of the many hundreds of thousands of fathers or fishermen to get a Gillette razor in the new plastic box gift case. If so, you've had a good close look at Sylvania injection custom molding.

You might have noticed that despite deep, thin-walled compartments, surfaces were smooth and clear and that in traditional Gillette fashion, the hinged top was securely latched but opened easily. And you probably guessed that the case was produced in high volume to meet the needs of America's gift-giving families, and Gillette shaving fathers.

A job like this calls for molding experience, facilities, and ingenuity characteristic of Sylvania. That's why manufacturers large and small take their custom-molding problems to Sylvania. Why don't you?

Write for this new brochure. It outlines Sylvania's complete custom-molding facilities, and might suggest how they can be put to work profitably for you. Write for information, too, on Sylvania's custom metal stampings; clad, plated and alloy wires; plated metal strip; custom wire welds, and special electronic components.



Snap-on hinges make it possible to mass-produce this Gillette polystyrene box in two pieces, quickly and economically snapped together to form the complete unit. Sylvania's ability to hold close hinge tolerances was an important factor in making this simplified design.

Sylvania's complete plastics services include mold making, compression, injection and transfer molding, and finishing and assembly operations.

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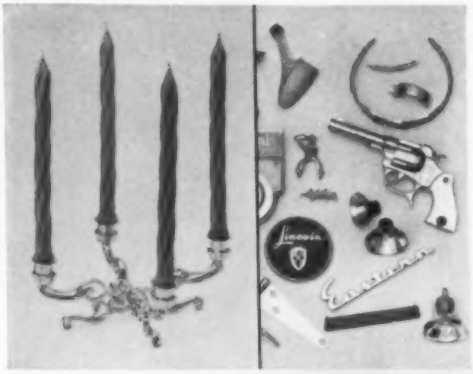

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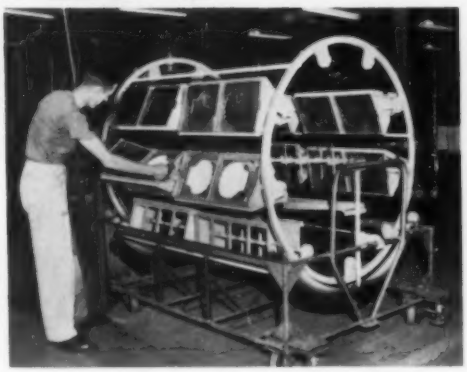

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ing the rate of polymerization, and stabilizing the monomers against other types of deterioration. 7 pages. *Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.*

Packaging with plastics. "The 1958 Guide to Improved Packaging." Respective advantages and uses of polyethylene, styrene, phenolic, and vinyl in packaging. 8 pages. *Bakelite Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y.*

Printed circuits. Discusses etching of printed circuits with a solution of ammonium persulfate instead of ferric chloride. Supersedes May 1957 edition of this bulletin. Bulletin 90. 8 pages. *Becco Chemical Div., Food Machinery & Chemical Corp., 34 Sawyer Ave., Station B, Buffalo 7, N. Y.*

Epoxy-metal putty. Technical data on Flawmaster, an epoxy-metal compound used to fill blowholes, sand pits, shrinkage cracks, deep nicks and scratches, machining flaws, and porous areas in precision metal parts. 4 pages. *Carl H. Biggs Co., Inc., 2255 Barry Ave., Los Angeles 64, Calif.*

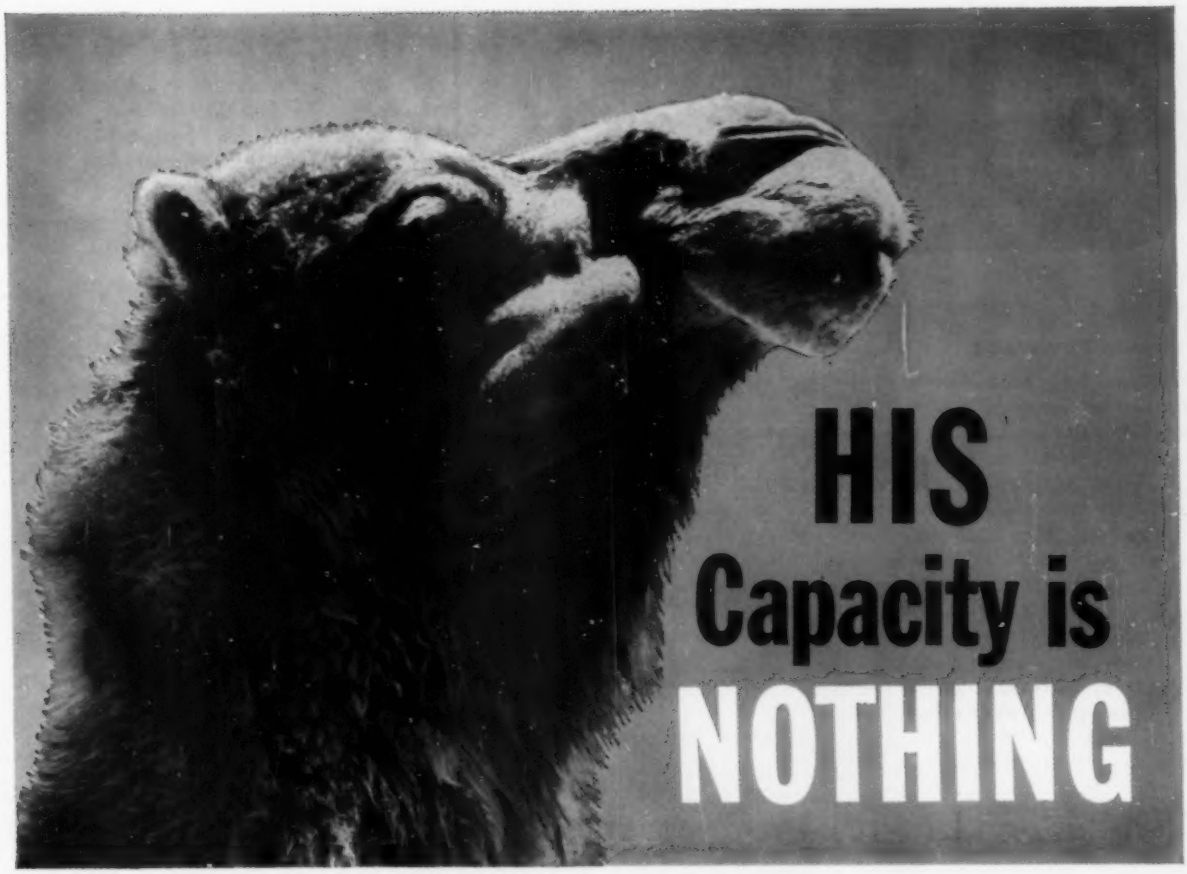
Compacting mill. Technical data on Allis-Chalmers compacting mill for converting or upgrading particle size, and controlling product density and product solubility factors. Bulletin 07B8836. 4 pages. *Allis-Chalmers Mfg. Co., 864 S. 70th St., Milwaukee 1, Wis.*

Glass-supported Teflon. Mechanical, electrical, and chemical properties of CDF glass-supported Teflon. Widths, nominal thicknesses, and thickness tolerances for standard and special grades of tapes and laminates, diaphragm and gasket stock, etc. are given. Bulletin GST-58. 8 pages. *Continental-Diamond Fibre Corp., Newark 45, Del.*

Weather resistant plastics. Handbook on selection of plastics for Ordnance Corps use in outdoor exposure. Data for 72 commercially available plastics materials, grouped as thermoplastics, thermosets, cellulosics, laminates, and elastomers. Handbook PB 131331. Price: $6.00. 268 pages. *OTS, U. S. Department of Commerce, Washington 25, D. C.*

Plastics panels. "Commercial Standard for Glass-Fiber Reinforced Polyester Corrugated Structural Plastics Panels" covers general-purpose and fire-retardant types of fibrous glass-reinforced corrugated plastics panels and includes requirements for materials, appearance, color uniformity, light transmission, transverse load, bearing load, and flammability. Manual CS214-57. Price: 10 cents. *Supt. of Documents, Government Printing Office, Washington 25, D. C.*

Vacuum forming. Results of a three-year project by U. S. Air Force on techniques and equipment for vacuum forming of plastic sheets. Report PB 131400. Price: $5.00. 211 pages. *OTS, U. S. Department of Commerce, Washington 25, D. C.*



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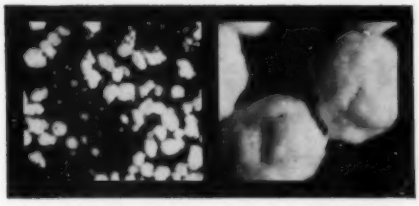

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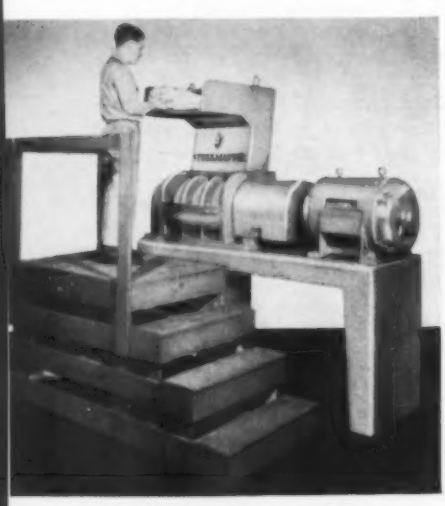
New Machinery and Equipment*

Vacuum Evaporator

Designed for precise deposition of evaporated coatings, a new production-size high-vacuum evaporator, the P-5, can be used for all types of vacuum coatings, such as aluminum, chromium, magnesium fluoride, etc. The evaporator has a stainless steel vacuum tank 36 in. in diameter and 42 in. high. It is expected to be used for low-reflection lens coatings and base plating of quartz crystals as well as for vacuum coating of plastics. *The New York Air Brake Co., 3529 Washington St., Boston, 30, Mass.*

Heavy-duty grinder

The "Steelmaster" grinder is intended to reduce lumps, bleeder scrap, and heavy extrusions in tough plastics. Welded, extra-heavy construction; one-piece forged, alloy-steel rotor; extra-heavy flywheels; and double spherical roller-type bearings permit high-speed operation under impact loads. Long extrusions may be fed directly without pre-cutting (e.g., the unit has reduced standard lengths of 8-in.-diam. rigid PVC pipe of ⅝-in. wall thickness). Throat opening is 24 by 9 in., floor area required is 2.5 by 7 ft., and the unit stands about 7.5 ft. high. Drive motor can be either 40 or 50 hp. *Ball & Jewell, Inc., 24 Franklin St., Brooklyn 22, N. Y.*



Ball & Jewell heavy-duty granulator for the reduction of purgings, bleeder scrap, and heavy extrusions of the tougher plastics

Abrasive belt cleaner

A problem in the belt sanding of plastics is clogging of the abrasive with the material being sanded. The Hapomit Belt Cleaner is a rotary wire brush that will clean a heavily clogged belt in seconds. This hand tool is held against the running belt and braked to cause drag. The resistance is sufficient to enable the brush bristles to dig out the waste matter. *Henley & Co., 27 Spruce St., New York 38, N. Y.*

Roll leaf stamping press

The Kensol 15 is a hand-operated, rack-and-pinion-type press designed for hot stamping of flat surfaces up to 2 by 4 in. in area. Articles up to 6 in. thick can be handled. Throat depth is 6 in., stroke is 1.8 in., and the work table, which may be stationary or sliding, is 10 by 12 inches. The 200-w. heater plugs into 110-v. a.c. Over-all dimensions are: height, 24 in.; width, 12 in.; depth, 16 in.; weight, 106 pounds. *Olsenmark Corp., 124 White St., New York 13, N. Y.*

Powder-compacting press

The Model 50W is a mechanical 50-ton press with flywheel, pneumatic clutch, and spring brake. It is driven by a 7.5-hp. motor. Depth of fill is adjustable to 4.5 in., die float is adjustable to 2.8 in., and ejection strokes up to 4.5 in. can be had. Die opening size is 10 in., feeder opening is 2.2 in., and from 10 to 40 strokes/min. are possible. Standard features include a hydraulic head, a shuttle-type feeder, automatic lubrication, totally enclosed motor. Some optional features are useful in pressing complex shapes. *Baldwin-Lima-Hamilton Corp., Hamilton Div., Hamilton, Ohio.*

Portable laboratory pelletizer

New pelletizer has 8-in.-wide driven feed rolls, with a four-blade rotor, variable-speed drive, and a rotary brush to keep strands in line. Gears are changed to vary the length of cut of the extruded strands. Although this unit is completely enclosed, the discharge chute pulls out quickly, making the working parts accessible for fast cleaning. Mounted on casters, the strand-cutter stands about 6 ft. high, about 3 ft. wide, and 2.5 ft. deep. *Frank W. Egan & Co., Adamsville Rd., Somerville, N. J.*

Rust preventive for molds

A two-step aerosol treatment protects the highly polished surfaces of molds, dies, and other tools from the ravages of rust. Solution No. 1 is sprayed on warm or cold molds, then wiped off; it removes moisture and perspiration acids. Solution No. 2, containing a silicone-based protective fluid, is then sprayed on to form a long-lasting protective coating. Though it will not bleed out of holes, the second spray can be wiped off anytime afterwards. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Big injection machines

A long-standing problem of injection molding has been the control of the weight of the molded pieces. And this problem is closely connected with others: maintenance of tolerances, molded-in stresses, and strength properties. It has been shown that preplastication offers better control of

*Specifications and claims made and appearing in these pages are those of the manufacturers of the machinery and equipment described and are not guaranteed by MODERN PLASTICS.

Van Dorn

Automatic 2½ oz. High Production Injection Press

is FAST!

Up to 1200 cycles per hour (dry run)

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One operator can run 3 or more presses, for greater flexibility, and lower labor costs. Selective control permits semi-automatic operation.

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by semi-skilled help. With simple, handy controls, job can be set up in 20 minutes.

VERSATILE!

The sketches list only a few of the many thermoplastics molded on Van Dorns.

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Polystyrene Containers — over 720 per hour

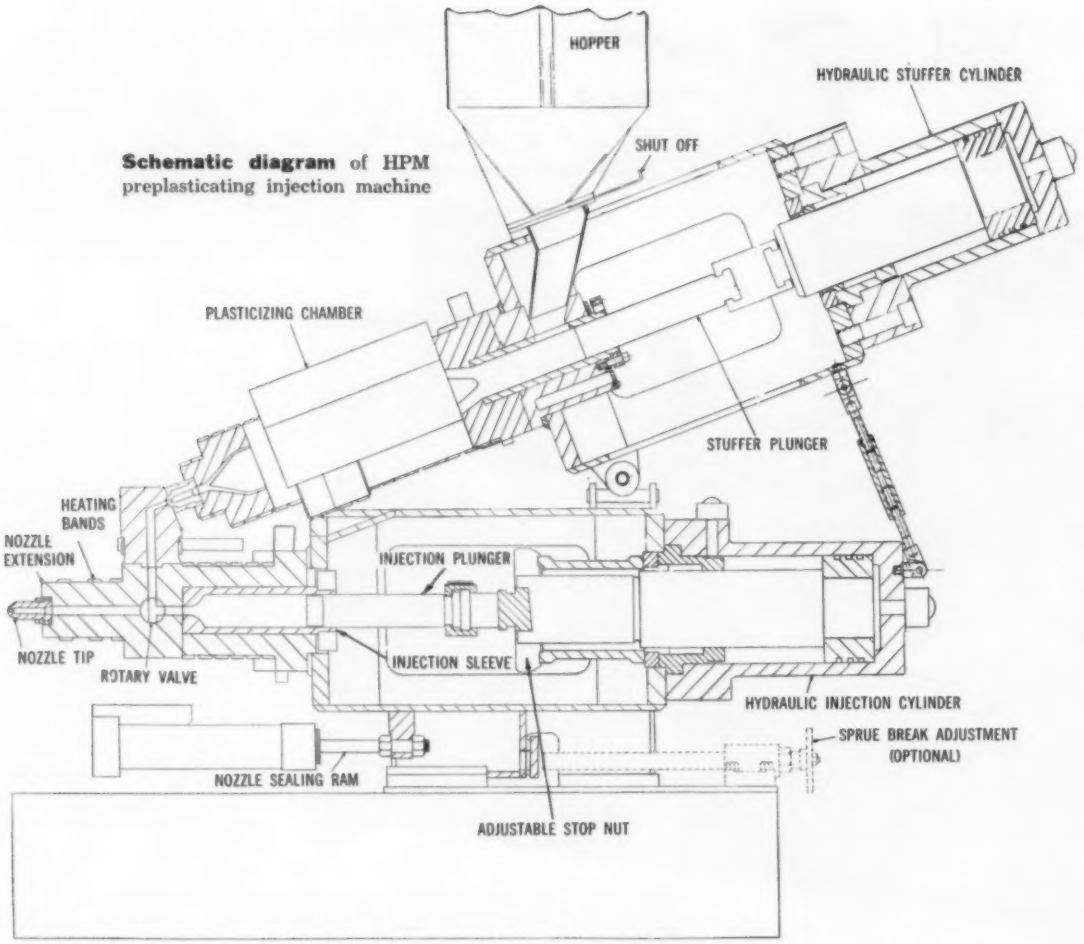
Vinyl Cord Sets — over 2000 per hour

Nylon Coil Forms — over 2000 per hour

Polyethylene Closures — over 9000 per hour

1. **Better material control**
2. **Close tolerances easier to maintain**
3. **Lower mold investment**
4. **Less waste in purging**
5. **Automatic cycling**

Many additional outstanding features of Van Dorn Presses are described in literature available on request.



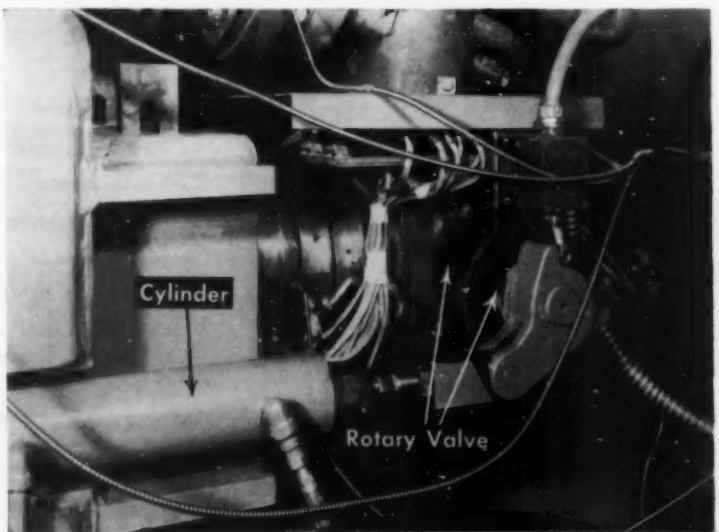
Schematic diagram of HPM preplasticating injection machine

shot weight than single-cylinder operation (see "Preplasticators pay off on small shots, too!" by H. H. Schwartz, MODERN PLASTICS 34, 143, Nov. 1956). Now the new HPM line of big preplasticating machines carries the fight for control a big step further.

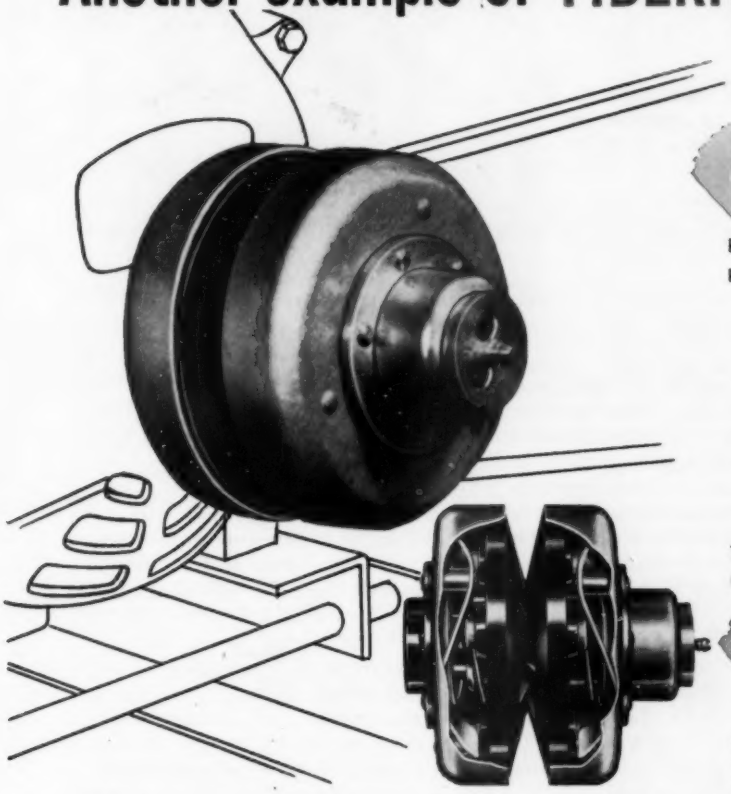
These machines, which range in shooting capacity from 80 to 300 oz., have a rotary, three-way valve between the preplasticating chamber, the shooting cylinder, and the nozzle. Also, during the stuffing phase, a preset stop-nut and pressure cut-off device accurately control the weight of melt stuffed into the injection cylinder. (See the accompanying diagram.) During injection, the valve is rotated 90° clockwise from the position shown in the diagram to shut off the preplasticating cylinder and allow the injection cylinder to discharge into the mold. When injection is finished, the valve, operated by an external hydraulic motor, rotates to the stuffing position, simultaneously closing off the mold. The injection ram is forced back to the stop-nut by continuous stuffing of small shots from the preplasticating cylinder. HPM people say this arrangement gives parts absolutely uniform in weight.

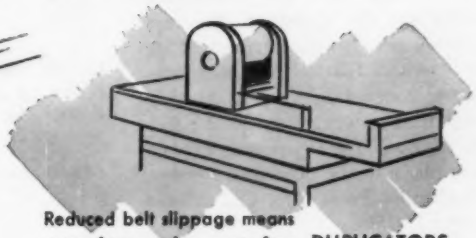
Clamping capacities are 450, 800, and 1500 tons for the 80-, 200-, and 300-oz. machines. All

Rotary material control of HPM injection machine is externally operated by a hydraulic cylinder and timed into the machine cycle by pressure build-up of the clamp circuit



Another example of FIBERITE at work . . .





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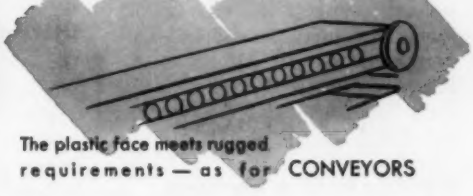
This popular "Hi-Lo" pulley permits speed changes—as for BAND SAWS



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2. Easily balanced pulley due to low weight Fiberite.
3. Good grip surface because V-belts and Fiberite cling to each other.
4. Corrosion is impossible!

The above advantages, plus easy workability and fast curing time enable Arrow Head Plastics to maintain high production for Equipment Engineering's incomparable variable speed pulleys.

To help you build your molding business, for solving new product problems or for improving old products, contact Fiberite on their versatile reinforced phenolic or melamine.

PRODUCT DESIGNER AND MANUFACTURER: *Equipment Engineering Co., Minneapolis, Minn.*

MOLDER: *Arrow Head Plastics, Minneapolis, Minn.*

MOLDING COMPOUND: *Fiberite cotton fabric reinforced phenolic No. 1330.*

Write, wire or phone for complete data on Fiberite formulations Department MP-4.

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CHICAGO OFFICE: Railway Exchange Building, Michigan Ave. at Jackson Blvd., HA. 7-1164.

WESTERN OFFICE: Riverdale Plastics, 8510 Warner Drive, Culver City, Calif., TE. 0-7733.

CANADA: The Bakelite Co., 40 St. Clair Ave. E., Toronto 7, Ontario.

THE FIBERITE CORPORATION

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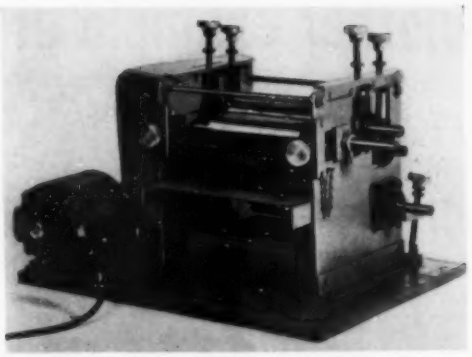
have been designed for very high rates of injection: 1530 and 2800 cu. in./sec. are the maximum rates on the standard 80- and 200-oz. machines, corresponding to 75- and 125-hp. pumping systems, respectively. Considerably higher injection rates can be had if desired. Daylight and strokes are made to the customer's order. *Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*



L. R. Wallace lab coater is available in widths from 8 to 40 inches

High-vacuum valves

It is important for fast pump-down in vacuum metallizing systems that the volume of the piping system be minimized. The VG series of 6-in. high-vacuum valves are extremely compact, having only 4 in. between the outside faces of the flanges. These valves are of the quick-opening gate type, and they serve at pressures well below the metallizing range. A variety of flange diameters is available, and bolt holes are fitted with stainless steel threaded inserts. *Vacuum Research Co., 420 Market St., San Francisco 11, Calif.*

Injection molding machines

A German maker offers several large injection machines of completely hydraulic operation. Now available in nominal capacities of 28 and 56 oz., with horizontal construction, these machines will soon be joined by a 111-oz. model and others with vertical locking rams and two-side injection nozzles. Specifications for the models now available are tabulated below. *Becker & van Hüllen, Krefeld, West Germany.*

Laboratory coater

Driven by a ¼-hp. motor, the Walco Model 57-L-1 laboratory coater is a four-roll machine available in widths from 8 to 40 inches. A variety of rubbers may be had for the rubber rolls of the set. Steel pressure roll is adjustable, so pick-up rolls need not be disturbed when material thickness is changed. All the rolls are power driven, with variable-speed drive if desired. *L. R. Wallace & Co., 172 N. Vernon Ave., Pasadena, Calif.*

Guillotine cutter

The "Autogil" cuts sheet stock into strips. Available in several models that cut sheets up to 5 or 15 in. wide into strips ranging in width from ⅛ in. and up, these power-driven machines can cut many materials, including thin metals and plastics up to 3/16 in. thick. Length of cut, feeding, and counting are all automatic at rates to 120 cuts per minute. *Hobbs Mfg. Co., 26 Salisbury St., Worcester, Mass.*

Weigh feeder

The Nemco weigh feeder's scale has two sets of graduations to facilitate accuracy, which is guaranteed to be within 1 gm. (about 1/30 oz.). Maximum shot capacity is 1010 gm. (about 35 oz.). A special compensator presumably offsets the accumulative effect of minute weighing errors. Rugged construction insures reliable operation under all molding conditions. *New England Engineering & Mfg. Co., 152 Chandler St., Worcester, Mass.*

Electrostatic device sorts metals from plastics

The Model ES16, a laboratory-scale electrostatic separator, detects and separates all metals from plastics through disturbances they cause in a localized high-voltage electrostatic field. The device will also pick out such contaminants as paper and string, and can even make some separations among plastics. Material is fed to the separator roller with a

Specifications of BvH injection machines

	Machine type		
	HM 1250/315	*HM 2500/500*	*HM 2500/800*
Effective injection volume, cu.in.	77	153	153
Specific pressure exerted on plastics, ton/sq.in.	9.7	9.7	9.7
Injection force, tons	88	137	137
Mold closing force, tons	345	550	880
Special Type: Mold closing force with intensifier, tons	440	690	1100
Mold closing stroke, in.	24.8	31.4	31.4
Mold space, in.	36.2x36.2	44.8x44.8	49.2x44.8
Maximum daylight, in.	39.3	47.2	47.2
Minimum mold height, in.	14.5	15.7	15.7
Effective width between the bars, in.	22.8x22.8	27.9x27.9	29.5x25.5
Operating pressure, lb./sq.in.	2845	2845	2845
Heating load, kw.	10	14	14
Drive power (hydraulic), kw.	17	32	32
Consumption of water in hydraulic system per shot, gal.	7.6	14.3	14.3
Shot capacity, weight, oz.	28.2	56.4	56.4
Plasticating output, lb./hr.	99.2	198.4	198.4
Over-all length, in.	295	348	358
Over-all height, in.	90.5	98.4	106.3
Over-all depth, in.	59.4	69	71

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Equipment

hydraulic systems • scales • granulators • drills • buffers & polishers • extruders • mixers • drill presses • pyrometers • accumulators • cutting tools • heat sealers • lathes • mills • grinders • embossers • molding presses • timers • calenders • duplicators • slitters • control instruments • hobbing presses • motors • ovens • heating elements.

Services

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vibrating feeder, and roller speed may be varied over a wide range, the speed depending on the particular separation being made; electrode voltage is also variable, from 0 to 40 kv., d.c. Industrial-size models will be available later. *Carpco Mfg., Inc., P. O. Box 3272, Jacksonville 6, Fla.*

Die-handling truck

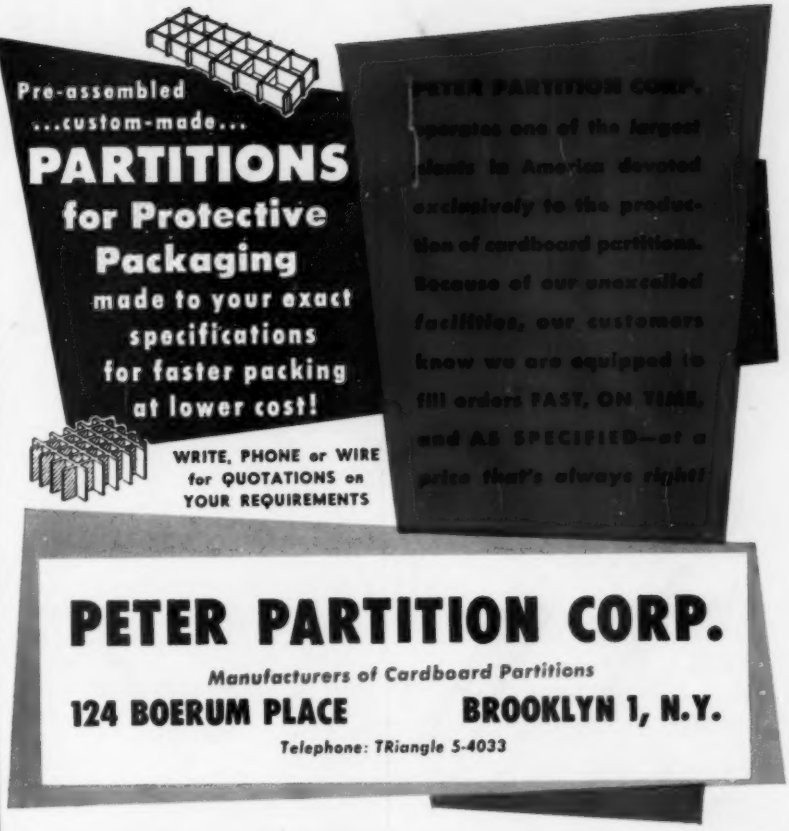
A hydraulically operated lift truck is especially intended to handle dies and molds weighing up to 7500 pounds. Electrically powered, the JackStacker is a walk-along-type truck equipped with a pusher-puller device that loads the die off or on the carrying platform. Platform is 42 by 32 in., pusher-puller stroke is 42 in., platform elevation, 52 inches. *Lewis-Shepard Products, Inc., 125 Walnut St., Watertown, Mass.*

Filing machine for plastics

The "R-Filemaster" will file most metals but is especially designed to handle soft—even sticky—materials without clogging. The unit is a motor-driven disk about 1½ in. thick and 10 in. in diameter (other sizes available) that has curved teeth on both the flat and edge surfaces. The rake of the cutting edges and the tooth curvature are designed to form a self-clearing, rolling chip. A 1-hp. motor drives the disk at either 120 or 240 r.p.m. (through reduction gears). Work table tilts, and cutting surfaces are available in three grades of fineness. *Hudson Automatic Machine & Tool Co., 137 38th St., Union City, N. J.*

Bench-type injection machine

A ¾-oz., bench-type injection molding machine is hand operated, has a variable transformer and thermostat to regulate cylinder temperature (which is indicated by a dial thermometer), and incorporates a special vise in the base for holding the molds. The vise is a quick-opening type with a cam action that operates a simple ejector bar. This speeds up operation considerably, so that as many as 400 shots per hour may be molded. Heater wattage is 250, top temperature is 570° F. Cylinder is made of nickel-chrome steel. The weight of this little molding machine is only 80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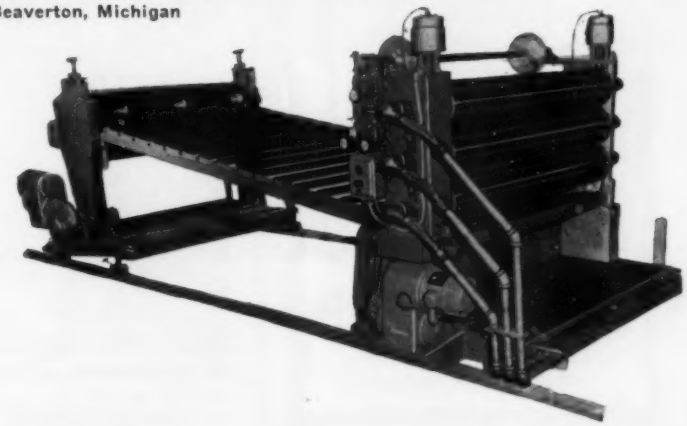

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Deep-draw attachment

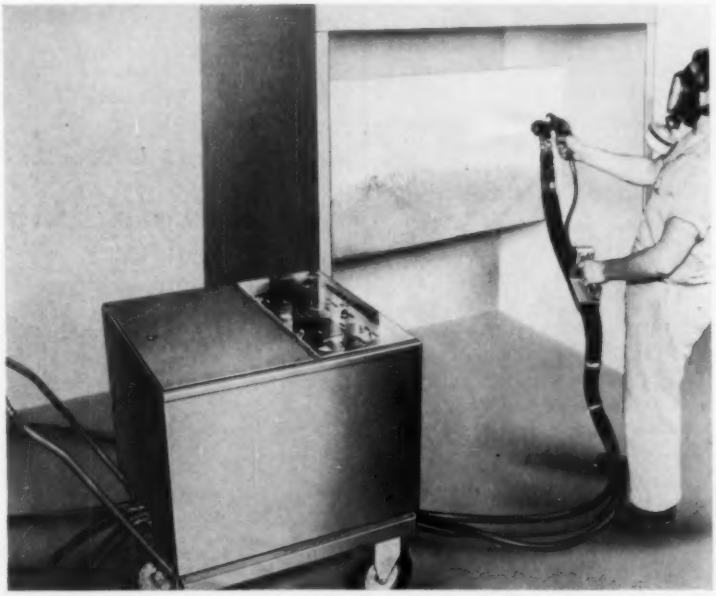
A new attachment makes it possible for owners of Auto-Vac machines to preform the softened sheet by an air blowing process. The last stages of forming are subsequently done onto a chilled female mold. As the sheet is stretched, it is confined on both sides by cushions of heated air, with the difference in air pressure causing the stretching. Thus, the sheet does not touch any cold surface during the initial forming stages. A heated assisting plug helps out, and the resulting shape, though it may be very deeply drawn, is more uniform in section thickness than it would be if formed by the plug-assist technique alone. Called "air cushion control," the attachment has been designed for easy incorporation into existing Auto-Vac machines. *The Auto-Vac Co., 1984 State St. Ext., Bridgeport, Conn.*

Extrusion aid

To achieve the "patent leather" look in extruded vinyl belting, etc., No. 2770 Plastiwax beads may be blended with the vinyl powder. The wax acts as a die lubricant, much improving the surface appearance. Since the percentage of wax used is usually in the neighborhood of 1%, the physical properties of plasticized vinyls are not noticeably affected by its incorporation. Plastiwax is odorless, tasteless, white, melts at 160 to 165° F., has a flash point (COC) of 515° F., and is soluble in benzene. *Lanair Co., 236 W. North Ave., Chicago 10, Ill.*

Foam dispensing machine

A portable modification of the Sweets system (see this department for July 1957) for dispensing polyurethane foams can be rolled through a standard width doorway, is compact enough to be carried in a regular station wagon. It is equipped with 25-ft.-long, ½-in.-I.D., heated hoses that make it possible to spray foam indoors or out. Delivery rates up to 30 lb./min. are possible. Rotary gear pumps, all bronze, are powered by a 1.5-hp., 230-v., explosion-proof motor. The two resin heaters can be run at 800, 1600, and 2400 w., with temperature controlled at 2° F. Optional spray gun permits application of foam to vertical surfaces. *The Martin Sweets Co., 114 S. First St., Louisville 2, Ky.*



Martin Sweets portable polyurethane foam dispenser has delivery rates of up to 30 lb./min.; optional spray gun permits application of foam to vertical surfaces

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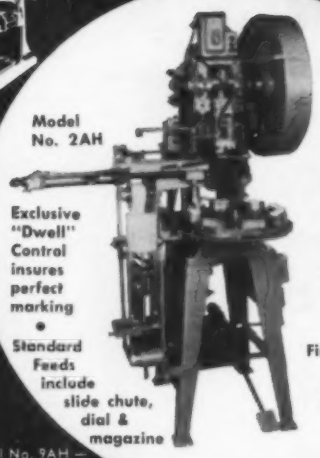

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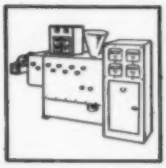

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IN USE IN THE UNITED STATES AND THROUGHOUT THE WORLD

Plastics

Production and sales in 1000 lb.* for November and December 1957

Materials	*Total p'd'n for the year 1957‡*	*Total sales for the year 1957‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester:		
Sheet, under 0.003 gage	18,567	18,029
Sheet, 0.003 gage and over	18,449	17,918
All other sheets, rods, tubes	7,582	7,236
Molding, extrusion materials	93,550	92,456
Nitrocellulose sheets, rods, tubes	4,085	4,115
Other cellulose plastics	5,358	4,738
Phenolic and other tar-acid resins:		
Molding materials[a]	183,812	176,661
Bonding and adhesive resins for:		
Laminating (except plywood)	59,330	46,547
Coated and bonded abrasives	16,678	16,565
Thermal insulation	51,845	51,824
Plywood	46,008	36,042
All other bonding uses¶	57,590	55,367
Protective coating resins	30,400	24,791
Resins for all other uses	36,849	30,957
Urea and melamine resins:		
Textile-treating resins	35,994	34,669
Paper-treating resins	24,274	22,840
Bonding and adhesive resins for:		
Plywood	94,824	91,917
All other bonding and adhesive uses, including laminating	33,171	30,708
Protective-coating resins	36,442	27,432
Resins for all other uses, including molding	89,324	90,659
Styrene resins:		
Molding materials[a]	415,044	398,339
Protective-coating resins	84,025	78,135
Resins for all other uses	146,592	122,680
Vinyl resins, total[b]	832,743	746,909
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		90,568
Sheeting (resin content)		56,526
Molding and extrusion (resin content)		214,809
Textile and paper treating and coating (resin content)[c]		66,461
Flooring (resin content)		81,377
Protective coatings (resin content)		31,519
All other uses (resin content)		50,623
All other vinyl resins for:		
Adhesives (resin content)		41,519
All other uses (resin content)		113,531
Coumarone-indene and petroleum polymer resins	251,018	249,519
Polyester resins	91,054	82,969
Polyethylene resins	690,705	650,419
Miscellaneous:		
Molding materials[a,d]	48,962	49,978
Protective-coating resins[e]	13,226	6,389
Resins for all other uses[r]	134,112	118,222

*Dry basis designated unless otherwise specified. †Revised. ‡Partially estimated. ¶Includes friction materials. [a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by the U. S. Tariff Commission

November†		*December‡*	
Production	*Sales*	*Production*	*Sales*
1,310	1,211	1,372	1,333
1,732	1,702	1,674	1,450
611	698	839	670
7,624	7,936	7,778	7,846
339	324	360	355
344	310	259	242
15,808	8,923	14,685	11,443
4,438	3,445	3,839	2,939
1,257	1,171	1,371	1,160
3,850	3,720	3,649	3,586
3,663	3,154	3,439	2,756
5,812	5,207	4,759	4,321
2,839	1,787	2,149	1,578
2,941	2,430	2,637	2,105
3,147	2,843	3,621	2,927
1,991	1,742	1,468	1,387
7,855	7,208	6,819	7,427
3,278	2,619	3,022	2,890
2,841	2,017	3,267	2,433
6,655	7,380	8,164	7,393
†34,824	†32,167	33,217	27,658
†7,472	5,918	6,771	5,732
12,987	†10,200	12,686	10,010
71,535	60,616	66,458	51,347
	†5,569		4,231
	5,142		4,396
	16,940		14,002
	6,151		3,936
	6,224		6,176
	1,916		2,073
	†6,212		5,345
	3,197		2,896
	9,265		8,292
19,718	†19,558	18,227	16,983
6,589	5,809	6,546	6,158
62,936	58,395	68,510	53,070
4,742	4,431	3,839	3,381
1,183	479	987	416
11,304	8,509	10,902	8,247

are given. [c]Includes data for spreader and calendering-type resins. [d]Includes data for acrylic, nylon, and other molding materials. [e]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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GETS IN THERE, EVERYWHERE, TO PREVENT STICKING!**

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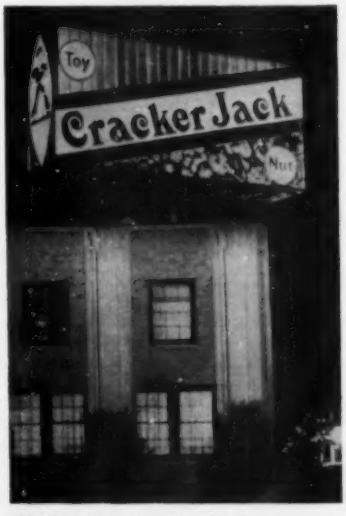
Front (right) and back (inset) view of the 30-ft. long rotating outdoor sign fabricated of translucent acrylic panels

Giant outdoor sign-package

Described as the world's largest candy box, a giant plastic replica of a Cracker Jack box, large enough to hold 228,000 regular packages of the popular confection, was recently erected on the roof of the company's general offices in Chicago. The huge illuminated sign, installation of which coincided with the firm's 85th anniversary, measures 30 ft. long, 14 ft. high and 6 ft. wide. Mounted on a steel mast extending from the roof, the display rises 48 ft. above street level.

Created by Federal Sign & Signal Corp., the colorful sign revolves day and night, three times per minute. Structurally, it consists of a rigid angle iron framework, bolted and welded together, with 58 translucent acrylic panels, 16 in. wide, comprising the sides and ends of the "package." Each plastic panel has a 90-deg. flange thermoformed along the edge so it will mount firmly against the adjacent panel and fit the metal framework channels. Because of the size of the sign, it was necessary to butt-join the sheets of $\frac{3}{16}$ in. acrylic (Plexiglas, Rohm & Haas) end to end to obtain the required panel length.

One face of the sign is a Cracker Jack package, enlarged 4000 times; the other, a replica of the company's Campfire Marshmallow trademark. Both end sections depict the Cracker Jack sailor boy and his dog. To obtain these effects, the transparent panels were pre-assembled in the fabricator's plant with lights behind them and painted on the exterior surface with acrylic-based paints. The completed sign, lighted from within by 224 fluorescent lights using 1568 ft. of tubing (two lights behind each panel), is visible for more than a mile. Total weight of the display, including the internally mounted motor drive and gearing, is five tons.



Night view of internally lit Cracker Jack sign

NEW Ferro Plastisol Stabilizers Reduce Your Costs!

Ferro Chemical announces the development of two new low-cost plastisol stabilizers with special advantages for you.

Ferro 1701 is a one package stabilizer for pigmented and filled plastisols. It provides good early color retention and excellent long term stability.

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Both of these new Ferro Plastisol Stabilizers give you low viscosity, low viscosity build-up and excellent air release properties for trouble-free molding, casting or coating.

Write, wire or call collect* today for samples and technical data on new Ferro 1701 and 1720.

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Ferro Chemical Corporation • Bedford, Ohio

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In Great Britain and on the continent (except Germany) Ferro Vinyl Stabilizers are manufactured and distributed under license by PURE CHEMICALS LTD., Kirkby Industrial Estate, Liverpool, England.

*Call collect . . . for samples, technical data or assistance on vinyl formulation or production problems. Call Cleveland, Ohio, BEdford 2-5320, Ferro Technical Service Department and *reverse the charges!* No obligation, of course!

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solves your color problems before we ship!

Check and double check! That's the motto of our modern color laboratory that serves as *your* quality control right in our plant. The lab works for you in three important ways.

First, it blends and develops Ferro Colors for your specific applications and materials. Colors that meet your specifications for color shade, dispersion and other qualities.

Second, our lab checks every shipment of your colors against your standards *under production conditions!* Actual samples are produced and checked for color match and uniformity.

Third, Ferro is continually testing and experimenting to develop new colors and to adapt present colors to new plastic materials. We also help you with technical data and application information on new methods for coloring clear resins in your own plant.

Ferro Dry Coloring techniques for all types of plastics, and Paste Coloring techniques for polyester and epoxy resins, have reduced raw material costs and eliminated waste and storage problems for many producers.

These are just three reasons why more and more molders, extruders, and other plastic producers are standardizing on Ferro Colors. Write us today for samples and information on how Ferro High Fidelity Color Service can help you!

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Phenolic missile nose

The satellite carried aloft by the recently launched Vanguard was protected during its ascent by a nose cone molded of asbestos-reinforced phenolic.

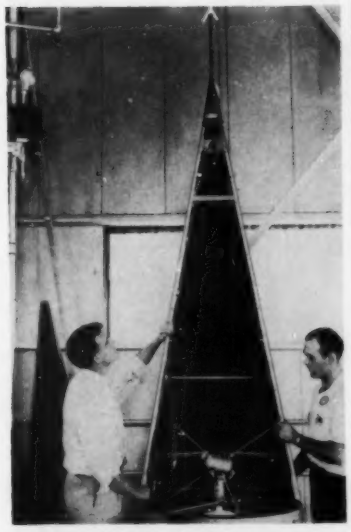
The cone is about 6½ ft. long and 30 in. in diameter at the base. Its function is to streamline the rocket and insulate the enclosed satellite from friction-generated heat.

The material was selected for this application because of its high strength-to-weight ratio and its strength retention at temperatures above 1000° F. It weighs 0.065 lb./cu. in., compared to 0.10 for aluminum, 0.17 for titanium, 0.28 for steel, and 0.32 for nickel —a favorable factor in rocketry where weight is of extreme importance.

In addition, the material has a high modulus of elasticity at low and high temperatures, and resists blistering, delamination, and erosion when subjected to high thermal shock.

The cone is produced by curing several plies of phenolic-saturated Pyrotex 41-RPD asbestos felt in a mold under heat and pressure.

Credits: Reinforcement by Raybestos-Manhattan, Inc., Manheim, Pa., Molding by The Martin Co., Baltimore, Md.



Half of reinforced phenolic nose cone. Satellite is at bottom. Other half of cone is in left background

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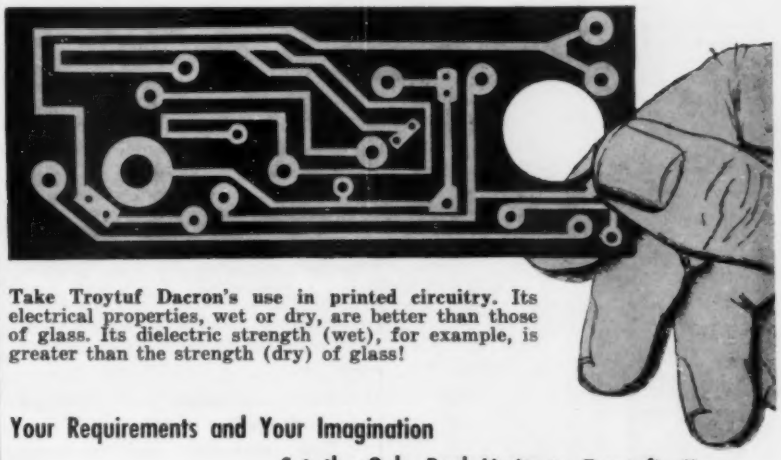
DACRON* and ORLON*
BLANKETS



Take Troytuf Dacron's use in printed circuitry. Its electrical properties, wet or dry, are better than those of glass. Its dielectric strength (wet), for example, is greater than the strength (dry) of glass!

Your Requirements and Your Imagination
Set the Only Real Limits to Troytuf's Uses

Troytuf Dacron and Orlon Blankets are extra-tough, light-weight reinforcing materials, specially suited to molding and laminating. They differ from most reinforcing media in that the fibres are tightly interlocked into easily-handled blanket form by a novel needle-punching operation.

Important: In some applications it is even possible to keep most of the properties and advantages of Troytuf blankets, while using them only as veils and/or overlays.

Which Big Troytuf Benefits Do Your Products Require?

- Higher abrasion resistance than glass
- Better resistance to corrosive mineral acids
- Exceptional weatherability (Troytuf Orlon)
- A safer material for food, drug-handling machinery and containers
- Smoother, better-looking finish
- Low moisture absorption
- More uniform fiber loading—no resin-rich corners
- Better formability after curing
- Elimination of pre-forming

Write us *your* laminating problem. We'll be happy to send you full details and samples for experimental molding. *Troy Blanket Mills, 200 Madison Avenue, New York 16, N.Y.*

REINFORCING **Troytuf** BLANKETS

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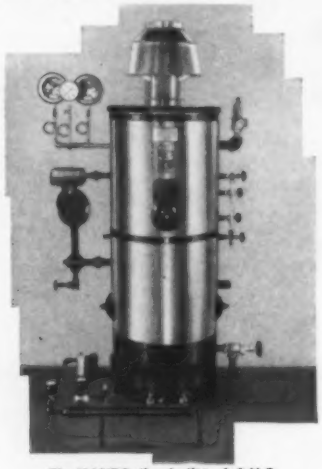
Searching for more floor space in your shop or plant can be very perplexing and expensive . . . especially when some of the vital space is being occupied by an old fashioned, cumbersome, horizontal type boiler. More and more shop and plant supervisors are now finding out how a KANE VERTICAL BOILER PACKAGE produces even better results within a much smaller space.



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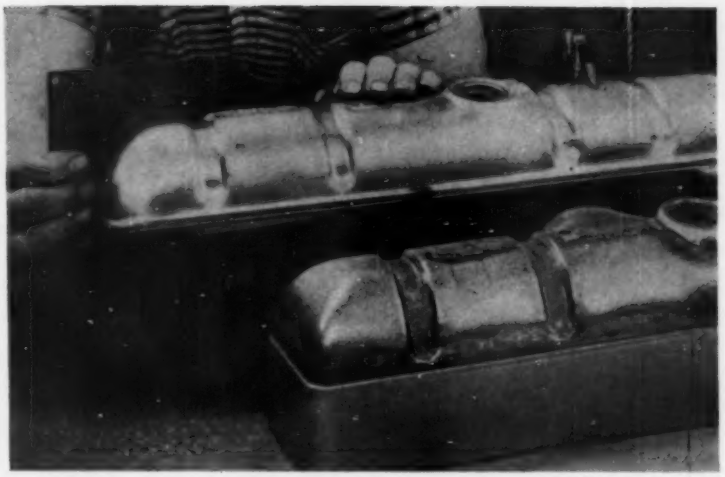


Inspection with templet shows part size and shape still up to par after 130,000 units had been produced from the same set of dies

Epoxy-alloy for metal forming

Medium production-run metal forming has been attained with plastic tooling through the use of a new epoxy-metal composition. Based on an epoxy resin system reinforced with metal or glass fibers and metal fiber flocking, this improved tooling method will permit runs up to 150,000 stampings of low-gage parts formed from the softer metals.

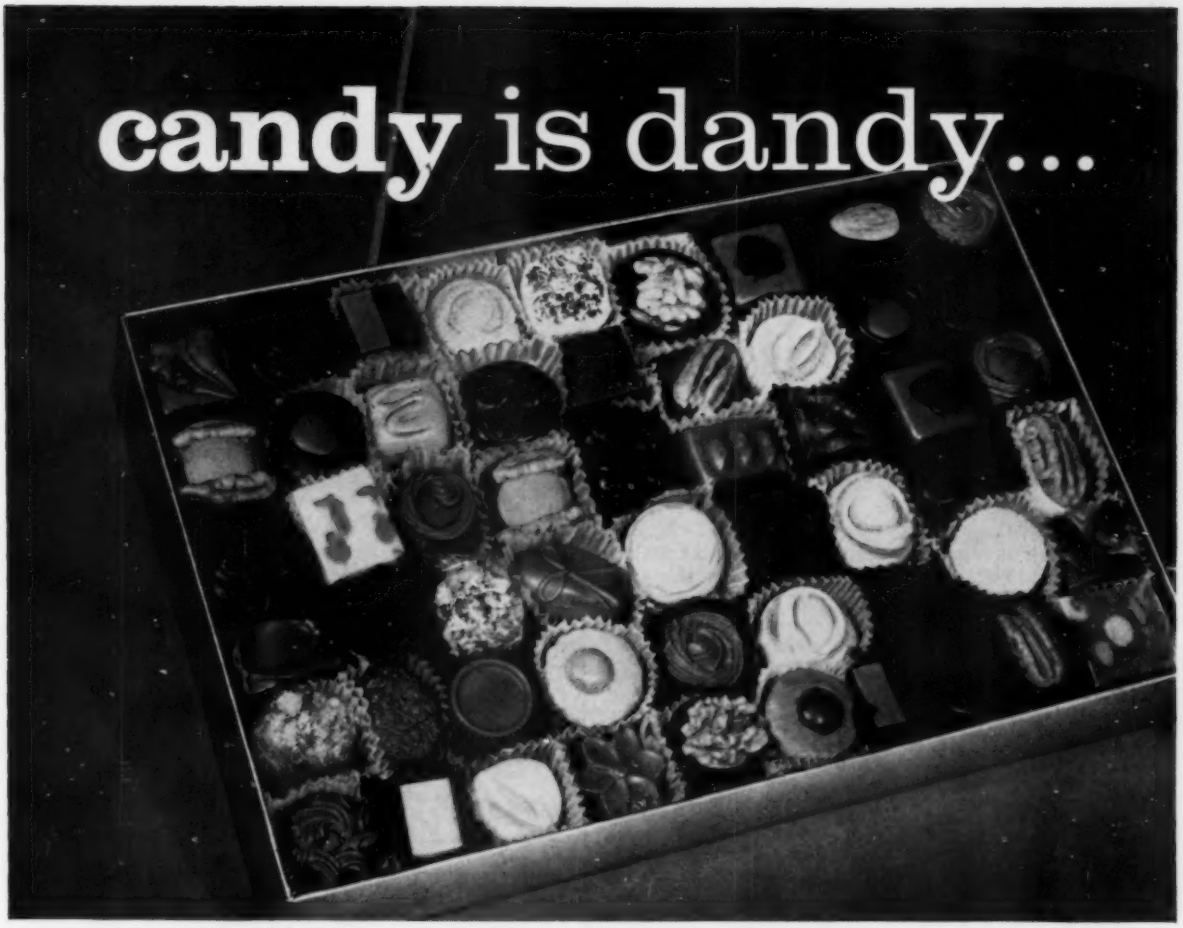
The material and process, known as Epoxy-Alloy, was developed by the Bakelite Co. The reduced tooling time and cost economies commonly associated with plastic tooling are inherent in the new technique. Improvements over conventional plastic tooling include mass casting of the tools and dies, increased thermal conductivity, and greater modulus and impact strength, according to Bakelite.

About 70 dies of Epoxy-Alloy have already been put into commercial operation. Over 130,000 stampings of a 0.025-in.-thick brass automotive radiator cover have been made from one such die. Another has formed more than 65,000 units from 0.035-in.-thick steel for a refrigerator section. This die was delivered in half the time that would have been necessary for a metal die. Recently, 35 Epoxy-Alloy dies for a military project were built at a cost of $250,000. Conventional metal tools—estimated cost $2 million—would have required much longer tooling time.

Tools of the new material have a surface composed of epoxy resin reinforced with chopped metal fiber flocking. The entire tool is pressure-cast and cured simultaneously.

Besides its use for production-run forming of the softer metals, Epoxy-Alloy is applicable to secondary operation dies, hydroform and rubber pad forming dies, stretch dies, and fixtures. On very short prototype or development runs, the new material can be used to form steel stampings up to ¼ in. thick.

Brass part for auto radiator formed on epoxy dies. (Photos, Bakelite)



but for display purposes,

Replicas made with A-C® Polyethylene are better!

It looks exactly like the real thing—but it isn't! Even placed side-by-side with a box of real candy, the exact copies are indistinguishable from actual candy. Made by Knechtel Laboratories of Chicago, they are used for display purposes by many of the nation's leading candy manufacturers. Other perfectly detailed replica work is done by Knechtel on meats, fruits and vegetables. And A-C Polyethylene is *the* basic ingredient in *all* of these items.

This is just one example of the many opportunities this new technique of slush molding with low-viscosity A-C Polyethylene offers. Profitable short runs are now possible because of low mold cost and low initial investment in equipment. Your engineers can design more detailed objects, which can then be executed by cheaper mold processes. A wide variety of part sizes and shapes is possible, too, ranging from small pieces like the candy above to 50-ounce parts. You can transfer to slush molding many of the parts now injection molded, doing it better, faster and more economically with A-C Polyethylene blends. These blends create an *entirely new material,* one that can be tailor-made to fit your needs. Wall thickness and finish can be controlled while maintaining faithful mold reproduction.

Polyethylene slush molding lends itself to hand pouring operations or semi-automatic and automatic machines at low pressures because of the low-viscosity characteristic of the A-C Polyethylene used. Whichever method you adopt, equipment and costs are surprisingly low.

You owe it to yourself to carefully consider this new, profitable process. Write *today* for full information, specifying your intended use of A-C Polyethylene. It helps us to help you.

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makes any plastic look better... sell better

The visual impression your product makes is half the sale! And, Nacromer, the synthetic pearl concentrate, will give your product the appeal that increases sales. Here's how:

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Nacromer completely overcomes the waxy, dull finish of polyethylene, providing a high gloss and transparency impossible to achieve any other way.

POLYSTYRENE

Nacromer endows this plastic with unequalled richness by creating a high pearly lustre of exceptional depth.

VINYL

Incorporated into this resin, Nacromer gives a smooth pearlized finish. Coated on embossed patterns, Nacromer adds sparkle.

ACRYLICS

Nacromer lends itself to pearlized patterns, swirls, and other unique effects in cast sheets and rods. In molded acrylics, it adds a distinctive pearly lustre.

ACETATE, CASEIN

Nacromer makes any plastic look better.

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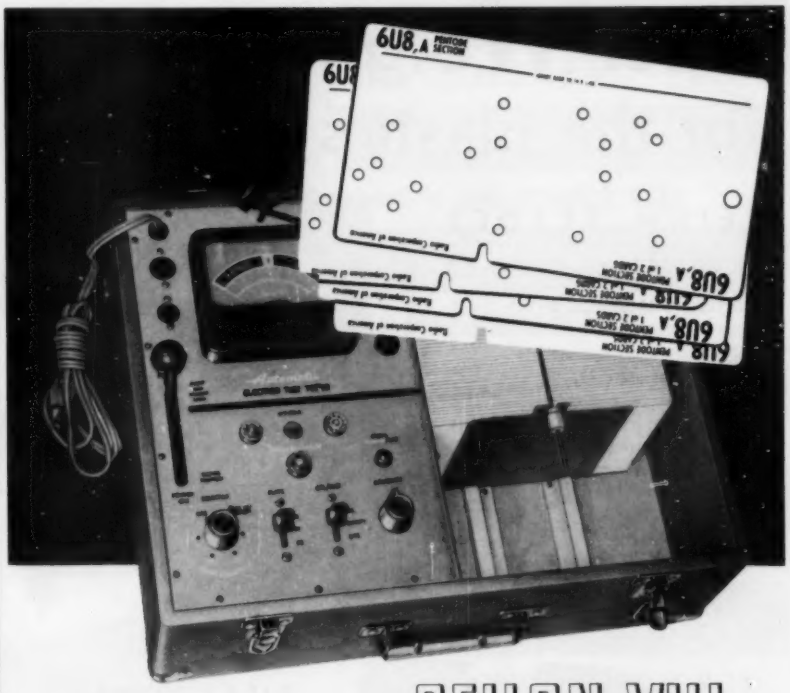
Artist Gabor Peterdi mixes acrylic beads (shown loose in foreground) with turpentine. Use of acrylic resin results in flexible painting, prevents cracking of finished canvas

Acrylic for artists

Amateur painters and professional artists are currently experimenting with a new oil paint medium that substitutes Du Pont's Lucite 44 acrylic resin for the natural resin known as dammar. Advantages claimed for the acrylic are 1) that it produces an oil which is fast drying, flexible, and stable; 2) that it helps retain brush strokes; and 3) that it seems to produce less yellowing and more light and brilliance from the pigments.

Chemically, Lucite 44 is normal butyl methacrylate, in contrast to commercial acrylic paints, which use methyl methacrylate. The methyl gives a harder coating; the *n*-butyl is more soluble in turpentine and provides greater flexibility. Price of the acrylic medium is 96¢/lb. in quantities of 60 pounds.

The present market for this application is very small. The acrylic is sold to artists in 1-lb. quantities, which is normally enough for six months of work. Not more than several hundred pounds are currently sold per year. However, the advantages inherent in the material make it a good candidate for the lucrative—and vast—do-it-yourself art field.



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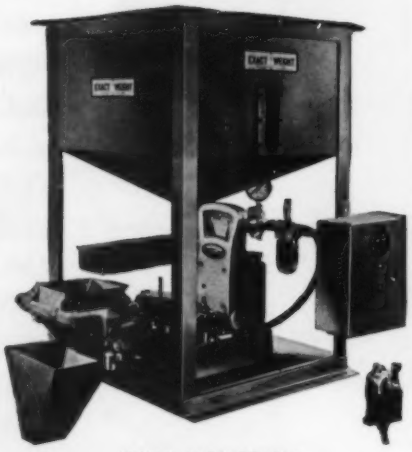

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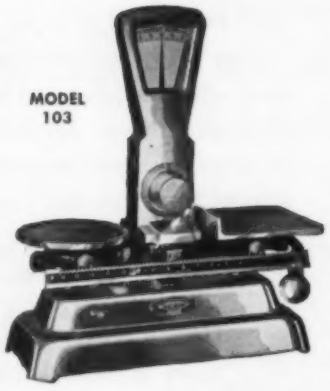

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BETTER QUALITY CONTROL . . . BETTER COST CONTROL

Radiation absorbers

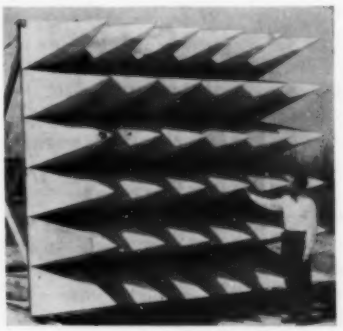
Flexible urethane foam, loaded with conductive material, has become an important factor in the efficient testing of antennas for both military and civilian use. In an application developed by Emerson & Cuming, Inc., Canton, Mass., the material is fabricated into broad-band radiation absorbers covering the v.-h.-f., u.-h.-f., and microwave-frequency range.

The primary purpose of such radiation absorbers is to permit the indoor testing of antennas with the same reliability of results as obtained outdoors, but without the many inconveniences of outdoor testing.

In operation, the loaded foam converts impinging electromagnetic energy into heat. Less than 2% of incident energy in the effective frequency range (50 mc. and up) is reflected.

The absorber illustrated, Eccosorb CHW 560, is fabricated by cementing urethane foam pyramids onto a frame, using Eccobond 45, a flexible epoxide adhesive. Resin-impregnated cardboard caps protect the points of the pyramids, whose bases cover the wall surface completely. The pyramidical shape was chosen to provide a maximum of foam surface while assuring complete coverage of all exposed room surfaces—within the limits of fabricating economics. For the sake of appearances, the pyramids have been covered with a white spray-on coating.

The photo shows an outdoor test on the absorber itself. In practice, the absorber would be used inside a room, and all surfaces of the room would be covered with foam pyramids.



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- **CADMIUM COMPLEX V-122**
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- **BACAD (CO-PRECIPITATED) V-131**
- BARIUM CADMIUM COMPLEX V-132
- **BARIUM CADMIUM COMPLEX V-133**
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- **CHELATOR V-141**
- CHELATOR V-142
- **ZINC V-50**
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Write for Brochure and samples, Coast Manufacturing & Supply Company, P.O. Box 71, Livermore, Calif.

Disposable pen

By fitting the nozzle of an extrusion-fabricated polyethylene tube with a felt wick, Organic Products Co., an ink and lacquer maker of Irving, Texas, has produced a low-cost, disposable fountain pen for industrial and home uses.

The instrument, of conventional squeeze-tube design, measures approximately 4½ in. long and has a diameter of about ½ inch. It is filled with a marking ink which will write on practically all plastics, including Mylar,

polyethylene, and silicone; metals, including aluminum, magnesium, stainless steel, and tin; and on glass, rubber, leather, photographs, paper, and cloth.

The pen sells for $10 per dozen in quantities of 12 or more; in lesser quantities, $1 per unit.

To use the instrument, a molded screw-on cap is removed and the pen held in the conventional manner. A slight pressure of the writing fingers on the barrel saturates the felt wick with marking ink, and the pen is ready to write. When pressure is released, the ink is drawn up into the barrel, preventing all leakage.

Credits: Extrusion-fabrication of tube by Bradley Container Corp., Maynard, Mass.; Alathon 20 polyethylene by E. I. du Pont de Nemours & Co., Inc.; urea cap molded by Armstrong Cork Co.

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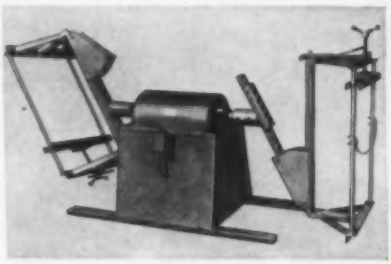
No more hoisting of drums —simply slide the drums into our floor-level loading arrangement



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With standard holders.....$625.00
With floor-level loading arrangement..... 675.00

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Hot subject

(*From pp.* 85-90)

of nylon film is that the best seal, according to Guild Electronics, is the one made in the shortest time. This is not surprising, considering the fast transition nylon makes from solid to liquid at melt temperature.

Some polyester films have been electronically welded. All the problems have not yet been worked out, though they promise to respond to study.

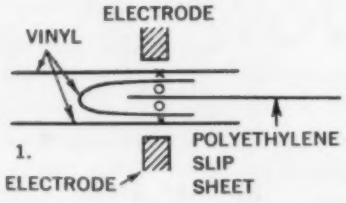
Improved techniques

Though the welding of newer materials is of great interest, the improved techniques worked out for vinyl—the bread-and-butter of electronic welding—are more important to the field. The technique of tear seal appliqué, introduced a few years ago, has blossomed both in terms of technical improvement and commercial usage. It is a method whereby three-dimensional designs in three colors can be applied to a base sheet of vinyl of a different color in a single operation. By this method, patented by Cosmos Electronic Machine Corp., New York, N. Y., it is possible to duplicate trademarks exactly, in full color, and dress up any vinyl article by adding color to it. A recent innovation by Cosmos is a low priced do-it-yourself kit whereby manufacturers of electronically sealed products can make simple appliqué dies themselves.

Tricks of the trade

Of great value for some applications is the slip-sheet technique, a trick of the trade which takes advantage of one characteristic of polyethylene generally considered undesirable; the fact that it cannot be sealed electronically. In slip sheeting, a layer of polyethylene is used to separate two layers of vinyl over areas between which a seal is not desired. With the process, flatter, more comfortable air mattresses, with less strain on the welds, are being manufactured (see sketches).

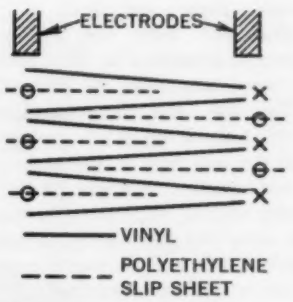
The same method, applied to the manufacture of large tarpaulins and industrial covers, speeds up production by putting several layers of material under the electrode at the same time



2. (INFLATED, SIDE VIEW)

(CONVENTIONAL AIR MATTRESS)
2A

Slip-sheet technique takes advantage of the fact that polyethylene is thermally inert to high-frequency radio waves. In diagram 1, seal occurs at X, but not at O, because of polyethylene slip sheet. Applied to an air mattress, the method produces a flat, internal rib (2) instead of a conventional rib (2a). With the new method, more comfortable mattresses can be made



Costs are cut by application of slip sheeting to electronic sealing of industrial covers and tarpaulins. In the diagram, seals occur at X but not at O. Using this method, large sheets can be produced in the form of an accordion, later stretched out flat

The lighter side of rubber and plastics . . . colorwise, of course . . . is achieved through the rutile titanium dioxides TITANOX*-RA, TITANOX-RA-50, and TITANOX-RA-NC.

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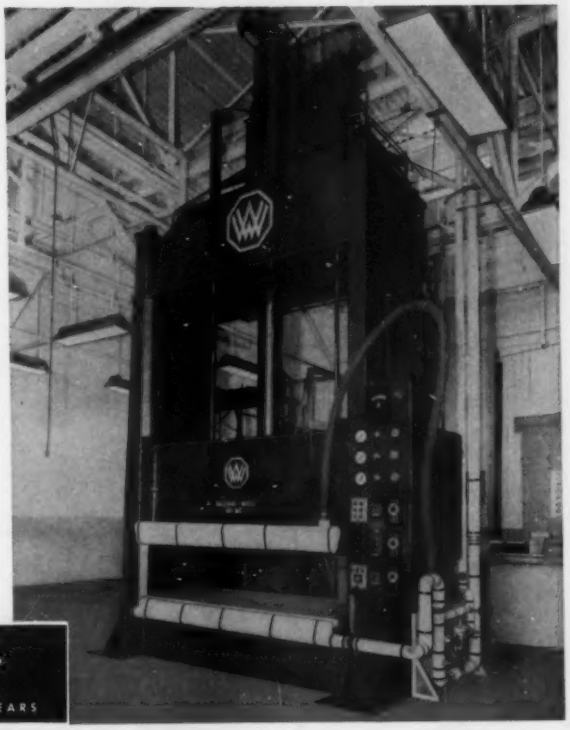

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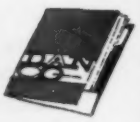

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MANUFACTURERS OF DYES—LACQUERS—
CLEANERS—ADHESIVES— FOR PLASTICS

and thus making many joints at once (see sketch, p. 204).

Another special technique is the "drape" method, whereby two seals can be made simultaneously at both ends of a long sheet of material. The press is designed to allow a large billow of material to drape down in the center, while the ends are placed under the sealing electrodes. This method has been employed to make complex seals on both lateral ends of an automobile seat cover at once.

Electronic welding, tied unshakably to the growth of vinyl, has an assured future. In terms of sales, the previously mentioned survey found that users of electronic welding equipment plan to increase their machine ownership by 20% in the next five years. But this is a matter of number of machines, not how much work they will do. Generator wattages are expected to be much higher than they have been, equalling in the next five years, in terms of power, purchases made over the past twelve. Also, the 20% increase figure given is based on present applications only: the brightest areas are the new applications in prospect.—END

Good seal has bead at each end (above), produced by extrusion of molten material. Beads provide reinforcement at points of stress. Thickest and therefore strongest part of properly welded piece is seal. Tears will not occur at seal but near it (below). (Photos, Bilnor Corp.)

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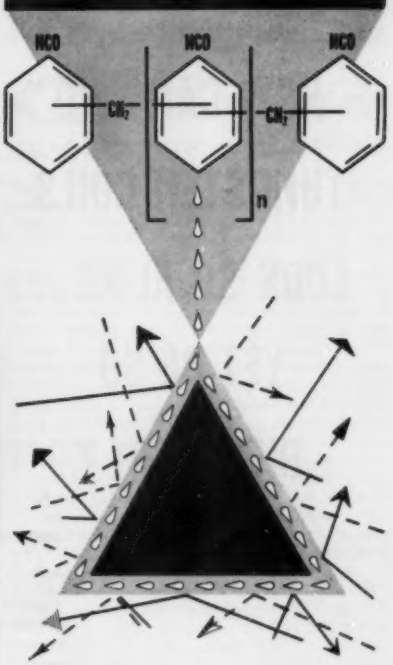
(Polymethylene polyphenylisocyanate)



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EXCELLENT ADHESION

PAPI provides *excellent adhesion* for rubbers, vinyls and other substrate coatings with polyesters and polyamides.

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PAPI is a nonvolatile reactive isocyanate that is *not* hazardous to use in formulating.

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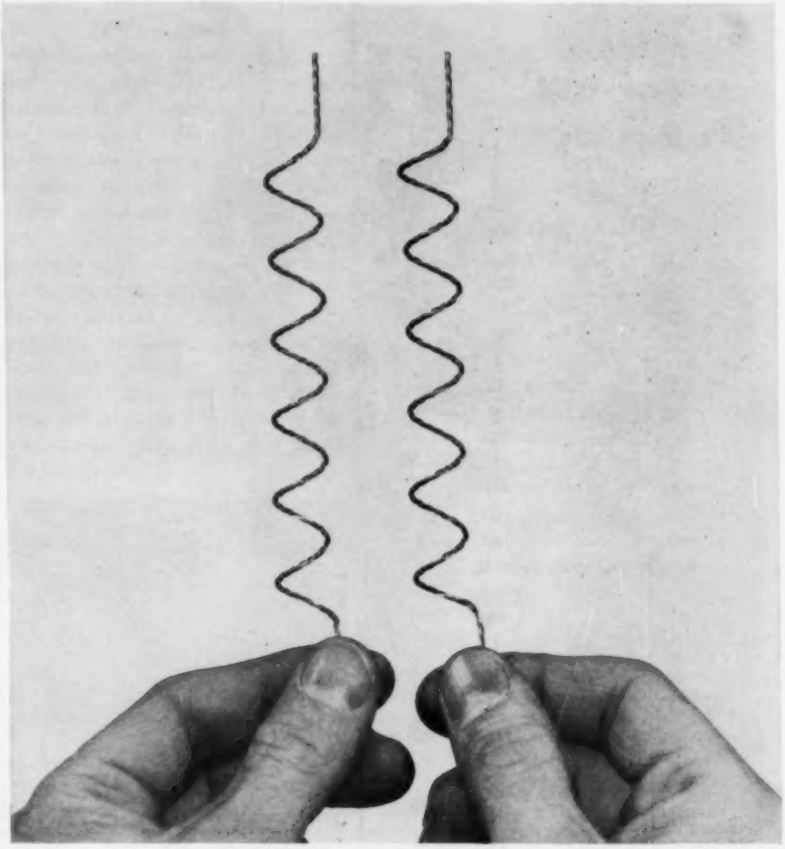
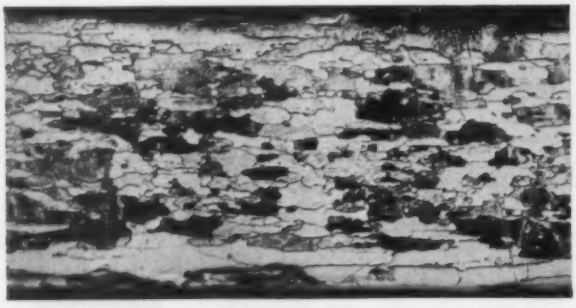


The tungsten metallizing coil at left will be "burned out" long before the other. It will lose its strength and become brittle sooner. But the coil made from General Electric "Long-Grain" Tungsten, at right, has extra strength. And it lasts longer because G-E "Long-Grain" Tungsten gives extra support to the coil.

Here's why it pays vacuum metallizers to specify General Electric "Long-Grain" Tungsten



ORDINARY TUNGSTEN. In this pair of photomicrographs, you see the big difference in tungsten wires. This is ordinary tungsten that's used in vacuum metallizing. After being "shot," the internal structure recrystallizes into short grains—an open invitation to the aluminum (or whatever metal is being vaporized) to seep in. Thus—brittleness, shorter life.

G-E "LONG-GRAIN" TUNGSTEN. Recrystallized, it forms a protective "armor" of longer, overlapping grains that lock out the aluminum because there are fewer grain boundaries. Metallizing coils are stronger, longer lasting. For assistance in using "Long-Grain" Tungsten, write: General Electric Co., Lamp Wire and Phosphors Dept. MP-48, 21800 Tungsten Rd., Cleveland 17, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Vinyl-metal

(*From pp. 102-105*)

subsidiary of Simonize Co., Chicago, is a former metal-cladding firm that has converted entirely to vinyl-to-metal laminating. It makes large sheets in its Denver plant that are used for wainscoting, automotive use, airplane paneling, trays, luggage, partitions, and curtain walls.

Arvin Industries, Inc. makes sheet laminate for radio and TV cabinets, automotive use, seat backs for school buses, wainscoting, and for a wide variety of cased products.

Enamelstrip Corp., a subsidiary of National Steel Co., Allentown, Pa., has a large coil laminating line, and its laminate is being used for TV cabinets, kitchen cabinets, wastebaskets, wardrobes, outdoor furniture, jewelry boxes, air conditioner housings, and other applications.

Jones & Laughlin Steel Corp., Pittsburgh, is starting up commercial production of laminated sheet stock.

North East Laminates produces vinyl-to-metal sheet for shipboard use, pleasure boat decks, and adding machine keyboards. It is also experimenting with non metallic core laminating.

Outer Laboratories, Analaska, Wis., produces sheet laminate for the gun cases it fabricates.

Thomas Strip Div. of Pittsburgh Steel Co., Warren, Ohio, is setting up a coil laminating line for a range of uses.

Poloron Products, Inc., New Rochelle, N. Y., produces sheet laminate for luggage, ice chests, picnic jugs, record players, auto uses, and other applications.

Shwayder Bros., Inc. operates sheet laminate plants in Denver and Detroit. The Denver plant, one of the world's largest luggage manufacturing plants, makes laminate for a line of luggage. The Detroit plant's laminate is used for folding tables and chairs, juvenile furniture, and a whole range of other applications.

O'Sullivan Rubber Corp., Winchester, Va., produces sheet laminate for cabinets, housings, and many other uses. A recent application was a case for the Wurlitzer portable electronic organ.

Hood Rubber Co. makes sheet laminate for housings, cabinets, and other uses.

United States Steel Co., which developed its own plastisol coating process for metal, recently entered the laminating business and is currently setting up a sheet laminating operation.

John Sommers, Ltd., England, is a sheet laminator for housings, cabinets, wainscoting, and other uses.

Phenix, S. A., Belgium, previously noted as the largest foreign laminator, may well be the *world's* largest vinyl-to-metal laminator. In 1957 the company's output was over 3,000,000 square feet.

What's ahead?

A prediction for the future of vinyl-metal laminates was made at the beginning of this article. That prediction is based on the present state of the art and on present economics. The process speeds production of formed metal products, minimizes rejects, saves on over-all costs, and provides highly resistant decorative finishes that can be obtained in no other way. But that above prediction may prove to be very low as adhesives are improved, faster processing is made possible, and forming and welding techniques are perfected.

Mechanical bonding of plastics to metal

A new approach to the problems of bonding thermoplastic materials, including polyethylene and polytetrafluoroethylene, to all types of metal sheets, developed in England, uses no adhesive. The metal sheet is perforated and formed in a single combined operation which can be carried out on standard flat progressive presses, or on a standard rotary press. The area surrounding each hole is slightly dished, thus transforming the metal sheet into an array of small, cup-like indentations.

When the plastic material is spread over the upper surface,

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heat and pressure force some of the plastic material through the holes to fill the indented areas underneath. This process will therefore anchor the plastic securely to the metal sheet at every hole.

In this mechanical bond—to distinguish it from an adhesive bond such as described in the foregoing article—no surface adhesion is developed, so that fractional independent movement remains possible. Vibration, climatic changes, variables in coefficient of expansion, and even deterioration of the plastics material (such as hardening of the polyvinyl chloride), are not likely to cause a separation of the lamination.

The process, developed by J. V. Eurich, lends itself to any type of thermoplastic material which is capable of being plasticized to a consistency permitting it to be squeezed through the perforations. The holes vary in size, according to the purpose for which the lamination is intended, but for average usage a 1/16-in.-diameter hole is specified, with 1/4-in. spacing in either direction also recommended.

In bending, deep-drawing, swaging, etc., the holes must, of necessity, assume a degree of ovality in relation to the angle of bend or curvature of form, so that the plastic material is held tighter as the angle of bend increases.

Because of the "dishing" of the perforations, the metal sheet assumes greater rigidity, and, it is claimed, the gage of the metal sheet can be reduced without loss of strength. British calculations indicate that the value of the metal saved not only pays for the cost of the plastics coating, but also for the operational costs as well.

The process also lends itself to double laminations, with plastics material on both sides of the metal sheet. For this purpose the perforations can consist of plain holes, because the plastics material is welded to itself through each hole.

The mechanical bonding process can also be used to bond plastics to timber, plywood, and other materials.—END

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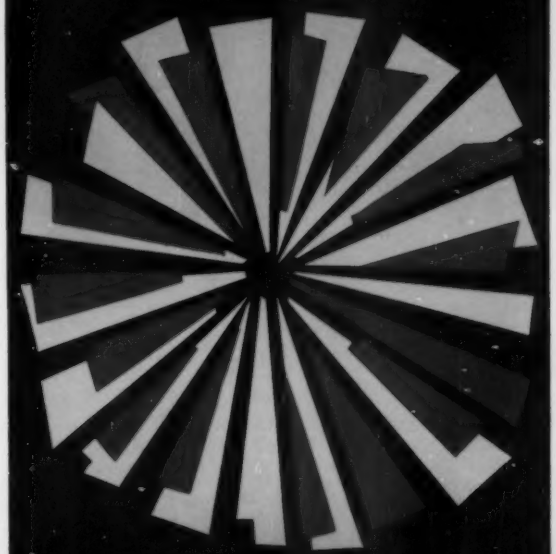

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(*From pp. 91-93*)

is much more durable than the other films. And only a few months ago an announcement was made that the University of Kentucky was experimenting with Mylar polyester film for greenhouse glazing. The film was modified to boost its resistance to sunlight. The experimental greenhouse consisted of a double layer of the polyester film tacked to a simple frame and cost 50¢ a sq. ft. to put up, including material and labor. Cornell University is also experimenting with an air-supported polyester film greenhouse that could be installed at the rear of any farm building.

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While a good deal of the work with plastics is still experimental, it has been definitely established that the installation of plastics pond and irrigation ditch liners can reduce water losses through seepage to a negligible amount.

Pond liners are generally fabricated of 4- to 8-mil vinyl or polyethylene film and are installed by placing the film in the bed of the pond and covering its edges with back-fill. Because of the rough usage to which they are subjected, plastic liners for irrigation ditches are generally

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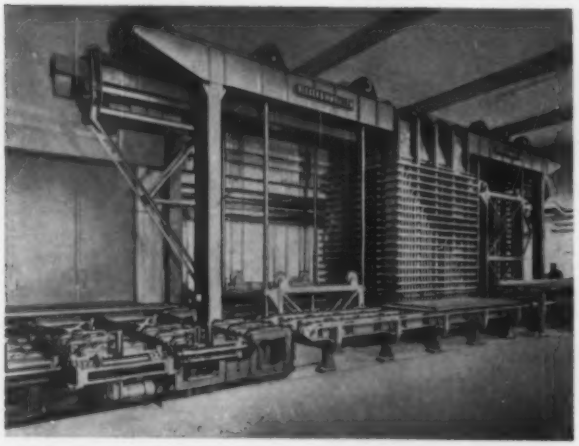

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fabricated of thicker sheeting, usually in the 10- to 20-gage range.

Work has also been progressing on the concept of flexible plastics irrigation tubes, which can be easily assembled in the field and rolled up for storage. In other words, a portable ditch with negligible loss of water through seepage or evaporation is the end result.

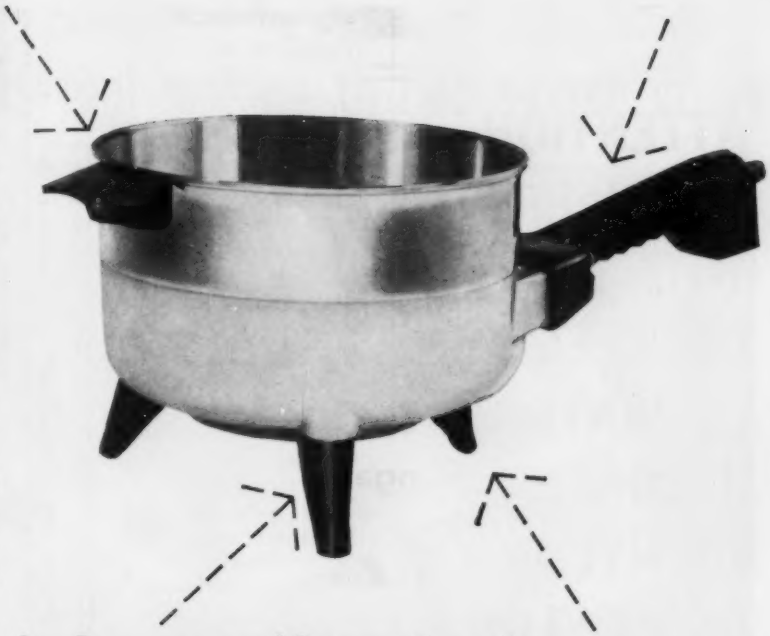
Pipe: In this country's rural areas, plastics pipe is used primarily as low pressure water lines to run from the pump house to the farm house or to distant pastures, barns, etc. It is not uncommon to find farms installing 600 lb. lengths of 3000 feet. One model farm in Indiana recently installed well over a million feet of polyethylene piping. The estimate was that in 1957 between 8 to 10 million lb. of virgin and scrap polyethylene went into farm water lines.

Irrigation pipe manufacturers have also been looking avidly at polyethylene. In 1957, the application consumed about 2 million lb. and manufacturers are waiting for technologists to come up with improved resins and thicker wall designs that will permit polyethylene to take a crack at some of the heavier duty applications. One of the new irrigation techniques which may help to maintain our descending water table is the dispensing of water underground through the medium of perforated buried polyethylene pipe.

Miscellaneous: Some of the other agricultural uses for plastics films which should be mentioned include the following:

Row crop covers for starting crops earlier; machinery and haystack covers; wrapping of balled roots, evergreens, rose bushes, and other perennials for shipment; shipping cut flowers, especially carnations; and covers for fumigating stored crops and soils in greenhouses.

Credits: This survey was based on information and papers supplied by the following companies: Monsanto Chemical Co., Bakelite Co., Spencer Chemical Co., Allied Chemical & Dye Corp., Eastman Chemical Products, Inc., and E. I. du Pont de Nemours & Co., Inc.



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Polycarbonate

(*From pp.* 131-138)

now gain the advantages of plastics and still retain strength.

Well-molded polycarbonate parts will withstand sharp hammer blows and generally the parts will deform before eventually rupturing. An injection molded safety helmet did not break after repeated impacts of 68 ft.-lb. in a falling ball test.

The dimensional stability of polycarbonate moldings under a wide variety of temperature, humidity, and environmental conditions, especially when coupled with impact strength and heat resistance, opens up a variety of potential applications. Many types of gears should benefit from the properties of polycarbonate resin. Gears for clocks, business machines, automobiles, appliances, and film projectors are good possibilities for improvement with polycarbonate molding compound.

Perhaps the most important application for polycarbonate resin will be derived from the fact that it may replace a metal part assembled from several components. Either by redesigning or simply by molding the assembly directly, a polycarbonate molded part could offer a cost reduction and possibly improved performance. A part composed of a gear, pinion, and shaft, made of three different materials and assembled, has been injection molded in one piece with Lexan molding compound. Die cast metal parts, especially those made from brass and zinc, look susceptible to replacement by polycarbonate resin. Figure 8, p. 138, contains an array of gears molded of polycarbonate, including complete assemblies.

There is a growing need for plastics with higher heat resistance. Parts for electronic equipment, appliances, and heating apparatus must meet increasing temperature requirements. The combination of transparency and heat resistance suggests uses for polycarbonate resin in lenses and instrument windows where environmental or illumination heat call for high temperature stability. The resin's superior heat resistance makes it suitable for these uses. In some cases, companies

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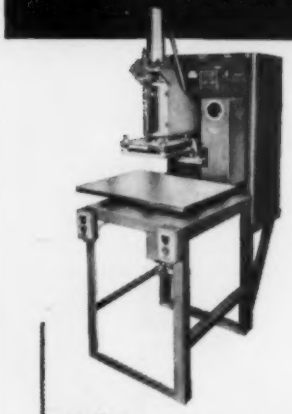

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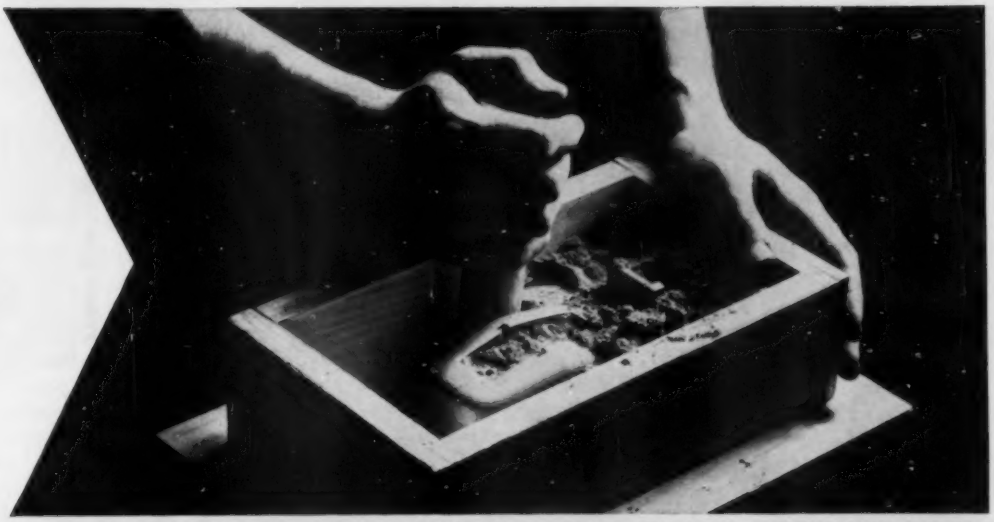

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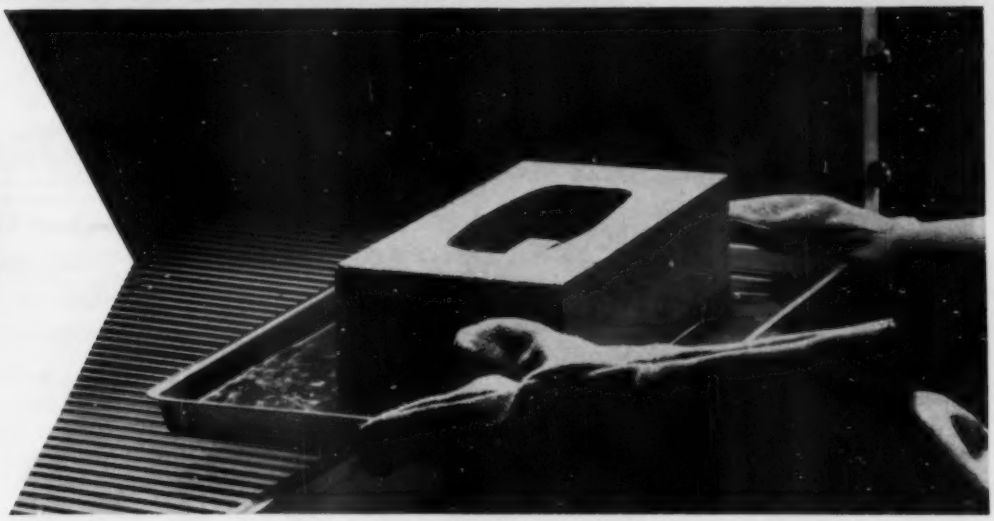

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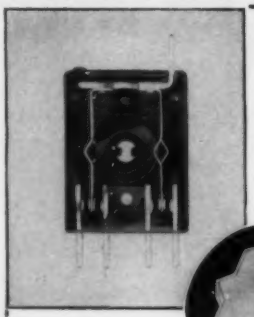

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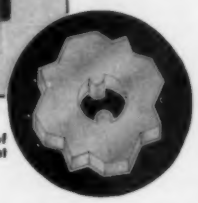

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that were contemplating thermosetting resins to obtain necessary heat resistance in certain parts, are now considering the use of Lexan molding compound which approaches thermosets materials in heat distortion temperature.

There is a trend toward smaller electrical equipment which usually results in increased operating temperatures. The good electrical properties and high heat resistance of polycarbonate resin should make possible its widespread use in the electrical field. Coil forms are a good example of parts that require toughness and heat resistance. An assortment of polycarbonate coil forms is shown in Fig. 9, p. 138. The small coil forms at the bottom are about ½ in. long with a wall thickness of 20 mils. The coil at the left was put in the mold as an insert and encapsulated by injection molding polycarbonate resin around it. Other electrical uses include wire insulation, structural parts, housings.

An interesting application area for plastic materials is the use of polycarbonate resin for fabricating fasteners of various types. Such uses as grommets, rivets, nails, staples, and nuts are under evaluation or have been proposed. The ability of polycarbonate parts to be cold-headed has developed considerable interest in rivet applications. Also, solutions of polycarbonate resin show promise as bonding or cementing agents in certain uses; the resin maintains its bond strength over a wide temperature range.

Small industrial parts of many types can be improved with the combination of properties of polycarbonate resin. Figure 10, p. 138, shows a variety of such parts. Cams, bearings, switches, levers, hardware, fittings, valves, and bushings have been produced.

Lexan molding compound is only one member of the polycarbonate family. As variations in properties are needed, other polycarbonate resins will probably be introduced. In addition to the molding compound form, the polycarbonates show promise as films, fibers, and elastomers. This versatile new resin may lead to a complete family of plastic products, each offering desirable properties in its field.—END

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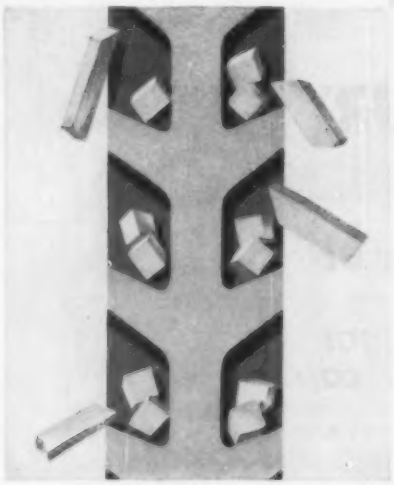

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Mechanical properties

(*From pp.* 139-148)

−70° C., machine-direction material can be elongated 50 and 30%, respectively, at the 1.76-in./sec. rate. In contrast, transverse-direction polyethylene breaks without flowing plastically at either the fast or intermediate rate. Because of this brittleness, the energy required to break the film falls off to −60° C.

Polyethylene heat seals

The polyethylene seals were made by placing a sheet of film on top of another and fusing one edge with a jet of hot air. This fin-type seal ran parallel to the machine direction of the film; thus, in testing, the seal is subjected to a peeling force and the film is stressed along the transverse direction. Tensile tests are summarized in Table III, p. 148.

The general trends that were observed for machine- and transverse-direction film appear to hold for seals as well. The ultimate strength increases with decreasing temperature and is practically independent of the rate of elongation, at least down to −70° C. At −70° C., however, the seal strength exhibits a marked dependence on elongation rate, decreasing appreciably as the rate is increased. Because of the slip-plane type of flow behavior of transverse film in the region of −15 to −45° C., many of the test specimens failed at the film clamp rather than at the seal root. When this occurred, the test became one of transverse film strength instead of the seal.

The ultimate strain and rupture energy of the seals are considerably less than those exhibited by the film. From Table III, it can be seen that the seals break under small strains at −60 and −70° C., regardless of the rate of extension. Rupture occurs at the seal root before the adjacent film has reached its yield stress. The extreme dependence of this brittle behavior on elongation rate is evidenced by the ultimate strain results. The brittle temperature occurs at −30° C. when the seals are subjected to the fastest rate of extension.

The energy required to rupture

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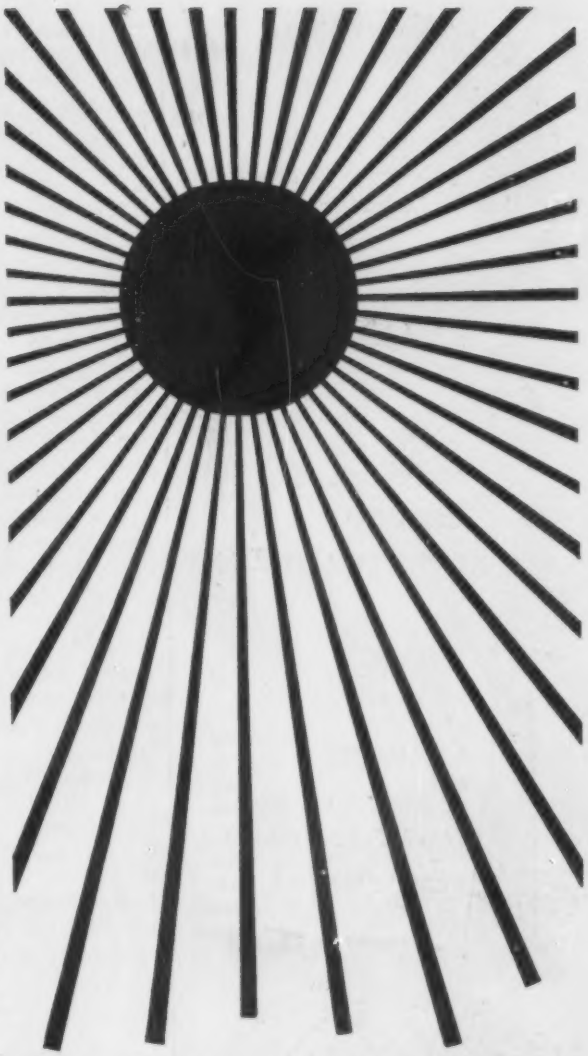

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a specimen of film containing a seal is presented in Fig. 8, p. 148. These curves illustrate the shift in brittle behavior toward higher temperatures caused by increasing the elongation rate.

Discussion and conclusions

To evaluate materials for a particular usage, it is frequently necessary to determine the behavior under one set of conditions in order to estimate what will occur under an entirely different set of conditions. Routine tensile strength and elongation data collected at a single temperature and rate of extension give very incomplete information on which to base a prediction of the performance of the material. It is necessary to know how the material reacts under various types of loading. The material may be subjected to impact forces or the stress may increase slowly.

By employing a tensile testing technique, the behavior of polyethylene film and seals has been determined over a wide range of temperatures. In addition, the effect of various stressing conditions has been examined by using elongation rates differing by a factor of 50. It has been shown that the ultimate strength and yield point of the film and seals increase with decreasing temperature. Ductility and energy to rupture, however, decrease at lower temperature.

The influence of time on the properties of polyethylene is clearly illustrated by the increase in yield point with increasing rate of extension and, at lower temperatures, by the decrease in extensibility and rupture energy at fast rates. The ductile-brittle transformation temperature of transverse-direction film and seals is particularly dependent on the time factor, and increases with increasing elongation rate.

It can be concluded that the performance of this polyethylene film at low temperatures will be less satisfactory under conditions of rapid stressing than when stresses are applied slowly.

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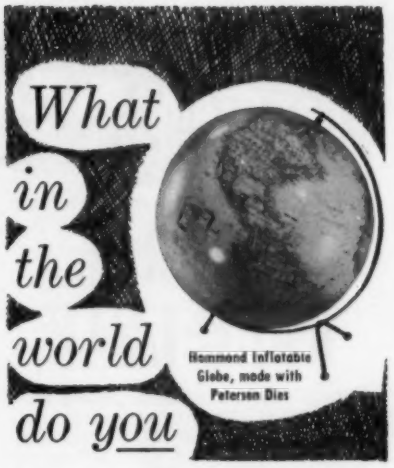

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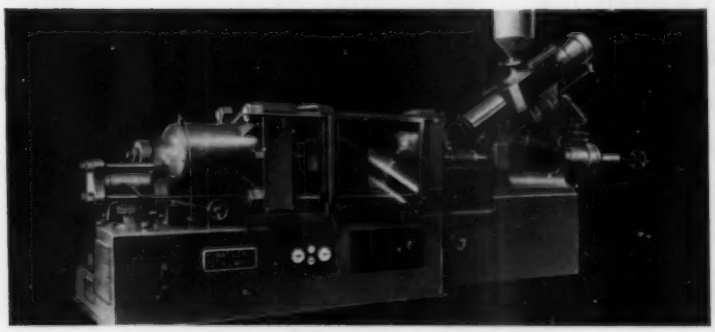

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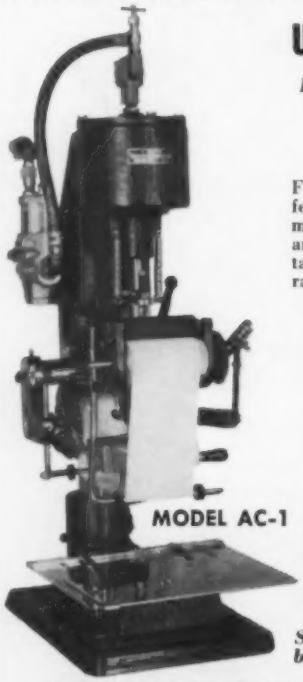

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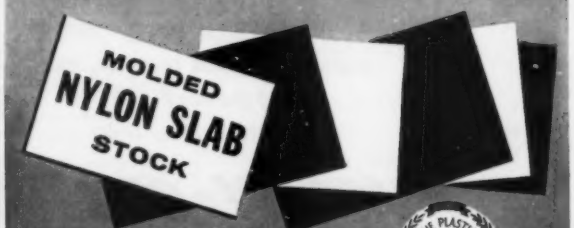

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Electrical properties

(*From pp. 152-156*)

equivalents of DDSA to epoxy shifts on the addition of polyethylene glycol. This shift is clearly illustrated in Figs. 4 to 6, p. 156, which present dissipation factor measurements at 25° C. The larger the proportion of P-1000 polyethylene glycol, the higher the ratio of DDSA to epoxy at the point of minimum dielectric loss (lowest dissipation factor). It may be surmised that some of the polyethylene glycol has reacted with the DDSA.

Another interesting observation is the fact that the minimum dissipation factors are more sharply delineated with dielectric measurements at the lower frequencies. Figure 7, p. 156, presents data on dielectric losses for P-200 and P-400 with clear cut minimums indicated beyond that of the 1:1 mole ratio of DDSA to epoxy when no polyethylene glycol was present.

Figure 8, p. 156, presents Shore D Durometer hardness values for different mole ratios of DDSA to epoxy and various amounts of P-1000. Good agreement of peak values of hardness with minima in dielectric losses is evident when Fig. 8 is compared with Figs. 4, 5, and 6. Although the maximum hardness is not as distinct as the minima in dielectric measurements, there is no doubt of optimum combining proportions. At the same time, water absorption tests have also demonstrated lowest values at the optimum DDSA/epoxy ratios for these systems.

Acknowledgment

The assistance of Kenneth Cressy and Edward Sarna of Furane Plastics, Inc., is gratefully acknowledged. Electrical measurements were conducted by Delsen Corp., Glendale, California.

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 (*Section 1 starts on p. 37*)

Versamid resins have host of uses

The versatility of its Versamid polyamide resins was recently demonstrated in a number of seminars around the country by General Mills, Inc., Chemical Div., Kankakee, Ill. The seminars were led by Dr. Harold Wittcoff, director of chemical research, and Dr. Don E. Floyd, head of the chemical application section. Some of the properties and uses of Versamids which are pertinent to the plastics industry are listed in the following paragraphs.

Low-viscosity resins. The company announced a new thermosetting development resin, XD-140, with properties similar to Versamid 125 but with a lower viscosity. It is expected to find applications where a solventless system is required, particularly in tooling and dies. The resin is also being investigated for coatings and potting and encapsulating compounds.

Polyamide-epoxy combinations are already well established and the firm is now investigating combinations of the resin with isocyanates, phenolics, polyesters, urea, and melamine. Dr. Wittcoff stated that the highly reactive 100 series of Versamids combined with the so-called heat-reactive variety of phenolic resins results in baking finishes which add flexibility, adhesion, and good alkali resistance to the acid resistance, solvent resistance, hardness, and toughness of phenolics. By a careful choice of resins and ratios of phenolics and polyamides, it was pointed out, an alkali-resistant, reasonably flexible composition may be obtained which still has much of the acid and solvent resistance of the phenolics.

Versamid-Hypalon combination. Another coating combination is Versamid 100 and Hypalon, Du Pont's elastomeric chlorinated and chlorosulfonated polyethylene. Hypalon, which has high ozone resistance and is extensible once it is cured or vulcanized, can be coated on stretchable substrates, such as rubber, and demonstrates good color stability on outdoor exposure. It also possesses good adhesive properties.

General Mills believes Versamid 100 is a better vulcanizing agent for Hypalon than the litharge or lead oxide traditionally used. Use of the polyamide results in films that are clear when unpigmented, that have high elongation, good light stability, good abrasion resistance, and improved adhesion to steel and substrates like GR-S rubber.

Plastic body solder. The company also revealed the development of Versamid-based sealing, joining, and filling compounds, some of which are expected to replace metal solders. The plastics solder may be used for sealing of panel construction in industrial buildings, as sealing and smoothing compounds in aircraft construction, in repair of metal castings, for sealing porosity in metal castings, and in repair and production of automobile bodies.

Thermoset adhesives. The key properties of Versamids in adhesive formulas were reported to be: specific adhesion to a great many surfaces, including fibrous glass laminates, wood, metal, and masonry; non-toxicity; and the ability to absorb shock.

Flexographic inks. The Versamid polyamides are said to be particularly noted for high gloss and good gloss retention characteristics and resistance to grease, water, alkalies, and alkaline detergents. These properties, plus strong adhesion to polyethylene, Mylar, saran, cellophane, nylon, and metal foil, make the resins useful in flexographic inks.

Although Versamids are frequently used by themselves in this application, their compatibility with modifiers in ink formulas further increases their usefulness. Among these modifiers are nitrocellulose, certain rosin derivatives, maleic resins, phenolic resins, and certain waxes. Rosin derivatives such as ester gums are sometimes added to raise melting points, increase hardness, and increase resin solids. They also help in bringing out the gloss. Certain phenolic resins may be added to increase hardness and smear resistance of the inks.

The ready solubility of Versamids in alcoholic solvents is important because such solvents do not attack the rubber rollers commonly used to apply flexographic inks.

Will continue expansion

No fear of over-expansion is exhibited by Henry H. Reichhold, president of Reichhold Chemicals, Inc., who says that his company has already contributed largely to chemical industry expansion and will accelerate at an even greater pace during 1958.

Major developments during 1957 included new isophthalic and alkyds for paints, a short-oil alkyd for baked auto finishes, the first phthalic anhydride made from naphthalene on the West Coast, two new synthetic resins to replace shellac in floor waxes, a resin plant in the Philippines, and a 30 million-lb. formaldehyde plant in South Carolina to be completed in 1958. New plants for production of formaldehyde and pentaerythritol and other products requiring formaldehyde or menthol will be built soon.

RCI's domestic sales for 1957

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exceeded $66 million and 1958 is expected to be better, said Mr. Reichhold. Dividends for 1957 were increased from 15¢ in cash and 1% in stock to 20¢ and 2% in stock. Sales have increased 10% for the past five years and a minimum rise of 50% is expected in the next five-year period.

A new project planned by RCI is floating tubular plastic bags for shipment of fuel oil or chemicals. The bags will be towed by tug boats and will reduce shipping costs by 60 to 80 percent. The type of plastic to be used has not been identified.

Pliovic dispersion resin

More information concerning Pliovic VO, Goodyear's new vinyl chloride dispersion resin first announced in MODERN PLASTICS 35, 41 (Feb. 1958), has been made available by the producer. Pliovic VO, developed for plastisols, is claimed to result in unusually high electrical quality.

Goodyear spokesmen state that plastisols have always been limited in electrical applications because of relatively poor insulating properties. The principal cause is soap deposited on dispersion resin particles during their manufacture. Lack of soap on Pliovic VO particles overcomes this obstacle.

Another advantage is that the new resin permits a wide flexibility in choice of compounding ingredients because of low initial viscosity and good shelf life. Laboratory evaluations show no increase in plastisol viscosity in tests with over 80 different plasticizers and plasticizer combinations after two weeks of aging. Included in the study are high-solvating-type materials such as Santicizers 141 and 160, which indicates that use of almost any plasticizer is feasible without excessive increase in viscosity of the plastisol.

The purity of the resin is assertedly obtained by a different system of drying than the spray method, in which the spray-dried product is separated from slurry by evaporation of the liquids, thus leaving non-volatile impurities behind with the resin.

This purity (lack of soap) is credited with giving Pliovic VO its low water absorption characteristics, which, in addition to extraction resistance, preserves the good electrical properties of PVC, maintains film clarity, and provides a dry, non-greasy texture in molded items.

Pliovic VO may also be combined with Pliovic AO, Goodyear's low-fusing plastisol resin. Such a blend will give fast fusion and increased pseudoplasticity. In such cases, the influence of plasticizer on flow characteristics is increased without a need for use of high oil, absorbing fillers, or other additives.

Still another claimed advantage for Pliovic VO is that lower-cost zinc-type stabilizers can be used, with test compounds showing no significant color change after 120 min. in a 350° F. oven when they were stabilized with a zinc chelator (*Mark PL*, Argus Chemical Corp.).

In addition to electrical wire coatings, the new plastisol is suggested for practically all standard plastisol applications, especially where uniform compound distribution in the mold and a non-greasy surface is desirable. When applied by spread- or spray-coating to metal, it assertedly won't delaminate after postforming.

Polyethylene pipeline

What is claimed to be the longest polyethylene pipeline ever installed for transfer of corrosive chemicals is now in round-the-clock use at the Ashtabula, Ohio, chemical complex where it links the zirconium and titanium sponge plant of Mallory-Sharon Metals Corp. and the sodium plant of U. S. Industrial Chemicals Co. It is used to transport a corrosive, saturated brine solution which is later broken down into its sodium and chloride components.

The line is 6200 ft. long and made up of 30-ft. sections weighing 120 lb. each. Wall thickness of the pipe is more than 1 in. and inside diameter 6.07 inches. It is fabricated from U.S.I.'s Petrothene high-pressure polyethylene resin with carbon black added.

PVC pipe with steel jacket

Pipe consisting of a 0.065-in.-thick rigid PVC tube and a 0.120-in.-thick resistance-welded steel jacket is being produced by Jones & Laughlin Steel Corp. at its Electric-weld Tube Div. plant, Oil City, Pa. Tradenamed Jal-Jacket, the pipe is said to be particularly suitable for service in the oil producing industry and where sour crudes cause short service life for unprotected pipe.

Victaulic couplings fit into mill-rolled grooves so that the pipes can be assembled or dismantled without damage to the lining. The pipe can be cut to make a square end. The company sells application kits containing rigid PVC collars and solvent cement which make it possible to join pipe of the same nominal O.D. size.

Jal-Jacket is presently available in 20-ft. mill lengths, 2-in. nominal O.D. size; 3- and 4-in. nominal O.D. sizes will be offered in the near future.

Progress in urethane foam uses

Improvements in cushioning characteristics, largely due to the development of polyether glycols, have led to an increase in the use of flexible urethane foams in the furniture industry and might make it possible to believe that the industry may yet reach that 100 million-lb. goal frequently predicted for 1960.

One leading manufacturer is marketing urethane mattresses trimmed from slab stock, and consequently, fully reversible. Light weight, strength, firmer support, and ease of handling are cited as some of the main advantages for the consumer and manufacturer. Several furniture companies are using the foam as full cushioning for convertible couches, indoor and outdoor

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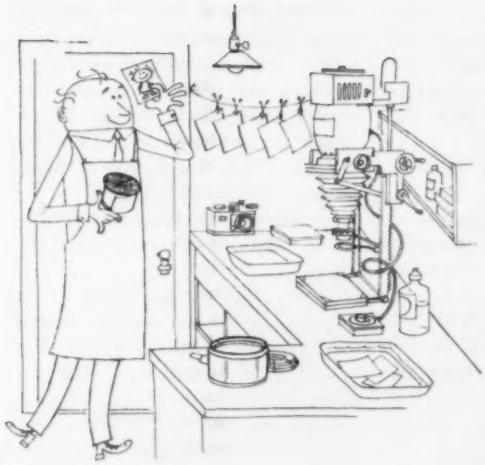

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Four different Styron formulations were employed, all of which have two things in common: exceptional moldability and unyielding resistance to chemicals commonly used in photographic processes. The tank wall and cover are Styron 700 in a special opaque camera black, selected for its high gloss finish and heat resistance. Styron 475 was used for the integrally molded center shaft and lower reel because of its excellent strength and ease of fabrication.

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furniture, and for unusually designed pieces, such as a "cuddle-chaise," which can now be easily moved about because of the lightweight foam.

Previously, urethane foam was used in furniture only in backs and arms and was featured by only a few manufacturers. This year, one foam supplier reports that 125 lines of furniture made by its customers would use urethane.

A manufacturer of the chemical raw materials used in the production of urethane foams reports that the furniture industry claims to have adopted the new cushioning material on its merits and not because of a price advantage.

In 1957, about 6 million lb. of urethane foam were used for cushioning. If the interest shown by furniture manufacturers is matched by consumer acceptance and automotive uses grow at the rate anticipated by the urethane foam industry, production of 12 to 15 million lb. of flexible urethane foam for cushioning purposes in 1958 may prove to be a conservative estimate.

Weather-resistant colored polyethylene

A new Tenite polyethylene formulation, specifically compounded with a recently developed ultraviolet inhibitor for use in molding or extruding outdoor products in natural or colors, is available in commercial quantities from Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., Kingsport, Tenn.

The company claims that the new compound will last two to four times longer outdoors than polyethylenes that contain no inhibitors. Film extruded from this formulation has remained pliable and smooth under accelerated weather testing in the Tenite Laboratories at least twice as long as film of the same thickness extruded from polyethylene without the ultra-violet inhibitor. The thicker the film, the better its weather resistance. Molded sections of the outdoor formulation are reported to show even longer life expectancy—up to four times greater than uninhibited material.

Outdoor containers, floor and deck matting, floats, buoys, covers for greenhouses, mulches, and silo, storage, and machinery covers are among the diverse products which can benefit from the new formulation.

The new formulation is currently available in red, orange, yellow, blue, and two shades of green, as well as natural color; more colors will be added as tests prove them satisfactory.

Ultra-violet absorber

A benzotriazole derivative, designed to protect plastics and other organic materials against the destructive effects of ultraviolet radiation, has been developed by Swiss researchers affiliated with Geigy Industrial Chemicals, Div. of Geigy Chemical Corp., Ardsley, N. Y.

Designated CH3457, the stabilizer is colorless at use concentrations, claimed to cut off radiation sharply below 3900 Å. units and to have good heat stability and low toxicity.

The company reports that the product, which is being distributed in experimental quantities, is compatible with PVC, polyesters, styrene, and other plastics.

As a result of increased interest in stabilizers, the firm has added a plastics laboratory to its Ardsley headquarters.

Plastic sewer pipe

Construction of a $500,000 plant at Aurora, Ohio, to increase its manufacturing facilities for Carlon "D" sewer and drain pipe has been announced by Carlon Products Corp., an affiliate of American Research & Development Corp.

Carlon "D" is made from a synthetic rubber-plastic combination, and a recent price reduction is reported to make it competitive with the bituminous fiber and slip seal tile pipes on the market. An improved formula is said to eliminate breakage problems.

The new structure will also include facilities for the manufacture of flexible and rigid plastic pipe. Another plant in Aurora for fittings for all types of plastic pipe was recently completed at a cost of over $300,000.

Coated board for film casting

New facilities which make possible economical application of solvent and aqueous coatings to paperboard stock up to 25 pt. thickness has been announced by Riegel Paper Corp., 260 Madison Ave., New York 16, N. Y. Previously, such coatings were available only on lighter weight papers.

According to the company, a number of these coated boards are already in use for plastic film casting, protective surfacing for decorative cover stocks, closure liners, for jars, etc. The coatings provide heat-seal or release from tacky materials, as well as resistance to moisture-vapor, grease, abrasion, or dirt.

Thermal antioxidants for polyethylene

A number of new additive combinations, said to be up to 10 times as effective as presently used antioxidants for polyethylene, have been discovered at Bell Telephone Laboratories, New York, N. Y. Certain substituted thioethers, when used in conjunction with carbon black, have been found to gain exceptional antioxidant activity over their use in clear polyethylene, according to the company. Alkyl, aryl, and heterocyclic thiols and disulfides without substituents are also effective antioxidants when used with polyethylene containing carbon black. About 0.1% of the sulfur compound with 3% carbon black is used.

Conventional antioxidants protect carbon black polyethylene formulations for less than 200 hr. under accelerated test conditions of 140° C. in an atmosphere of oxygen. Furthermore, the oxidation process becomes autocata-

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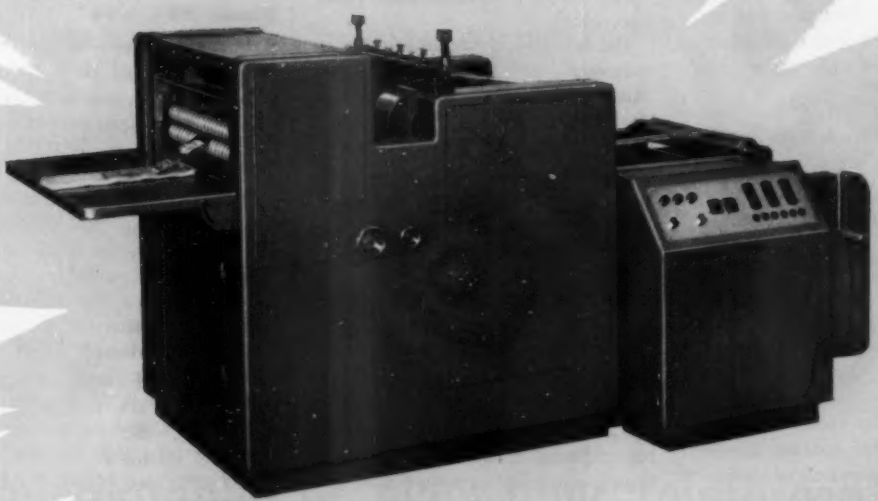

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lytic; that is, it reaches a point at which it "runs away" under such test conditions. With several of the new protectants, Bell reports that oxidation proceeds at a slow, even rate and does not become autocatalytic even after 2000 hr. at 140° C.

Some of the new additives, offer possible other advantages. By control of the molecular weight of the antioxidant, its diffusion rate in polyethylene can be varied. Also, high molecular weight antioxidants can possibly be added in large enough amounts to act as plasticizers for polyethylene.

The company has not yet announced plans for the commercial exploitation of these discoveries.

Intermediates from Catalin

Entry into the field of chemical intermediates and specialties with 14 new compounds has been announced by Catalin Corp. of America, 1 Park Ave., New York 16, N. Y.

The products include dinitrile azoisobutyric, used as a PVC blowing agent; Catalin UV-1, a cinnamic aldehyde derivative used as an ultra-violet absorber for methacrylate; sodium amide, used in the preparation of aminopyridines, dyestuffs, etc.; heptaldehyde, used as an accelerator for vinyl and rubber; and hydrazine sulfate, employed in organic synthesis.

Plasticizers reduced

A price reduction of about 10% for Santicizer 213 and Santicizer 214 has been announced by Monsanto Chemical Co. Santicizer 213 was reduced from 29½ to 27¢/lb. and Santicizer 214 from 32½ to 29¢ in tank car and tank truck lots. Drum prices were decreased by corresponding amounts.

The two compounds, introduced commercially in September 1956, are claimed to impart a low coefficient of friction to plastisol moldings or coatings, which results in good mold release and a very dry feeling to the finished plastic goods. They also impart low initial viscosity to plastisols, permitting a good flow in formulations which, upon fusing, produce highly rigid articles.

New former and fabricator

Robinson, Lewis & Rubin, Inc., 132 Lafayette St., New York 13, N. Y., is a new company engaged in vacuum forming, low-pressure forming, and fabricating. The firm offers proprietary industrial items and custom molding services using acrylic, styrene, polyethylene, etc.

Daniel Lewis, formerly sales manager of Durable Formed Products and vice president of Tiger Plastics Corp., is president. Sol M. Robinson, Irvin I. Rubin, and Irwin Robinson, officers of Robinson Plastics Corp., are treasurer, secretary, and vice president, respectively.

Speakers for vinyl fabrics

Increased interest in the many end-use applications of vinyl fabrics has prompted the Vinyl Fabrics Institute to establish a special Speaker's Bureau to service requests from trade, professional, and civic organizations.

The bureau will be composed of qualified representatives from the 17 member companies comprising the Institute, who will speak on vinyl fabrics in relation to the automotive industry, upholstery, luggage, rainwear, footwear, clothing, inflatables, etc.

Requests for speakers should be addressed to Vinyl Fabrics Institute, 65 E. 55th St., New York 22, N. Y.

Phenolic laminate

Paper-base phenolic laminate, Grade 320, which possesses good electrical characteristics has been introduced by Taylor Fibre Co., Norristown, Pa. It can be used in critical electrical and electronic circuits and where a high degree of electrical insulation is required. According to the company, the material qualifies for use under MIL-P-3115, type PBE-P specification.

Grade 320 is said to have low dielectric loss, high dimensional stability, insulation resistance, and surface resistivity. It is mechanically strong, resists fungus growth, and maintains electrical characteristics after prolonged exposure to high humidity. Applications include use in TV tuners, carbon-coated resistors, resistor cards, and terminal and connector strips.

The laminate is available in sheets approximately 49 by 49 in. and thicknesses ranging from 0.020 to 1 inch. Light in color, the material has a semi-gloss surface finish and medium translucency.

Bonds PVC pipe

A new compound for the permanent bonding of rigid PVC pipe sections and fittings has been announced by Schwartz Chemical Co., Inc., 326 W. 70th St., New York 23, N. Y. The bonding agent, called "PVC," is formulated from unmodified polyvinyl chloride.

According to the manufacturer, the compound quickly dissolves the surfaces of the plastic pipe and then joins them to produce a permanent fusion bond which becomes an integral part of the pipe. The drying rate is slow enough to allow its use on large diameter pipe and fittings.

The cement is recommended by the company for underground as well as exposed installations. It is available in a neutral gray color in 8-oz., 1-pt., 1-qt., and 1-gal. cans.

Gordon Research Conferences

Advanced theory and significant recent developments in selected branches of chemistry will be discussed in lectures scheduled for the 1958 Gordon Research Conferences to be held June 9 to August 29.

The series includes a conference on elastomers to take place at Colby Junior College, New London, N. H., during the week of August 4.

The chemistry of adhesion will be discussed at New Hampton School, New Hampton, N. H., dur-

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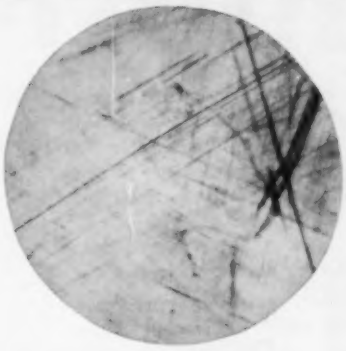

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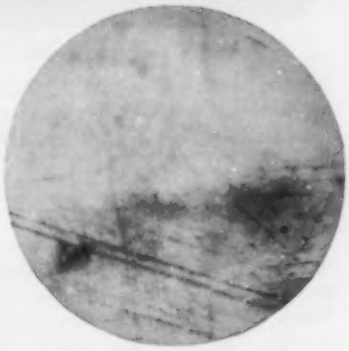
PARAPLEX P-444

24 MONTHS' EXPOSURE



UNEXPOSED

RESIN B

24 MONTHS' EXPOSURE

Photomicrographs of glass-fiber reinforced panels prove superior weather resistance of PARAPLEX P-444

Virtually no change after two years' exposure—that's the outstanding record of PARAPLEX® P-444 acrylic-modified polyester, as shown by these magnified (60 times) photographs of the surfaces of exposed and unexposed panels. Deterioration of conventional light-stabilized resins A and B resulted in minute cracks and crazes which cause erosion and bared fibers.

In these tests, PARAPLEX P-444 showed better initial gloss, and proved to have *87%* gloss retention after 24 months, compared to 1.5% for Resin A and 4.3% for Resin B. In addition, it proved to have 2½-3 times better resistance to discoloration than panels A and B.

PARAPLEX P-444 will give *your* glass-fiber reinforced materials the advantages of better initial transparency and color, and superior resistance to fiber blooming and discoloration. Write for detailed information on PARAPLEX P-444 and other Rohm & Haas polyester resins.

Chemicals for Industry

ROHM & HAAS COMPANY

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Representatives in principal foreign countries

ing the week of August 25. This session will include lectures on "Adhesion of Fibers to Elastomers," "Organic Adhesives," "Tack," and the "Role of Cohesive Failure in Adhesive Bonds."

The conferences, which were established to stimulate research in universities, research foundations, and industrial laboratories, are intended to bring experts up to date on the latest developments and to provoke suggestions as to underlying theories and profitable methods of approach for making progress. No publications are prepared as emanating from the conference.

Requests for attendance at the conferences, or for any additional information, should be addressed to W. George Parks, director, Department of Chemistry, University of Rhode Island, Kingston, R. I. From June 9 to August 29, mail should be addressed to Colby Junior College, New London, N. H.

Latex for rug backing

A combination of Chemigum-Pliovic latex that helps to prevent throw rugs from slipping are being used by Sanitary Laundry and Dry Cleaners, San Francisco, Calif., for rugs that are laid over slippery waxed rubber tile flooring on passenger steamships. Initial cleaning of the rugs removed the original backsizing. The new material, produced by Goodyear, is a combination of nitrile rubber and vinyl chloride latices and is said to give permanent adhesion that withstands repeated washing.

Fittings for polyethylene pipe

Straight insert and combination reducer fittings made of nylon for use with flexible polyethylene pipe have been introduced by Industrial Plastic Fittings Co., 3891 W. 150th St., Cleveland 11, Ohio. The company asserts that the fittings successfully withstood burst tests at a pressure of 1600 p.s.i.

The toughness of nylon makes these fittings useful as adapters to connect with metal installations. Its corrosion resistance and ability to withstand temperatures exceeding 250° F. makes it possible to use plastics fittings where formerly more expensive metal fittings were required.

According to the firm, more than 12 million of its styrene copolymer fittings are now in use in the field.

Nylon-to-nylon cement

Pressure-bonding cement specially formulated for bonding nylon extrusions and moldings to nylon and nylon to metal has been developed by Ions Exchange & Chemical Corp., 44 Leonard St., New York 13, N. Y. Designated Nylosil 820, the bonding agent requires no priming, welding, or heat-curing.

The company reports that joints bonded with Nylosil cement are impermeable to water and hydrocarbons; resistant to chemicals; and possess good flexibility and high tensile strength. The cements set at room temperature and are available in a wide range of viscosities.

New material for dinnerware

Tyril, a new thermoplastic styrene-acrylonitrile copolymer developed by The Dow Chemical Co., is a new entrant in the plastics dinnerware field which enjoyed estimated sales of $70 million in 1957. Two molders, Gitsware Corp., Chicago, Ill., and The Ohio Art Co., Bryan, Ohio, recently introduced dinnerware sets made from the material.

According to Dow, Tyril can be fabricated more easily and at lower cost than competitive materials, and molders are now able to offer dinnerware in a medium price range. Starter sets (16 pieces) will retail from $11 to $15.

Major features of dinnerware made from the new material include resistance to breakage, food and coffee stains, and retention of food odors. It is said that the dinnerware can be washed satisfactorily in most automatic dishwashers.

Dow has created a special label for use by molders of Tyril dinnerware. The label will be released only to producers maintaining stringent standards of design and manufacturing techniques and will be subject to recall at any time dinnerware no longer meets those standards.

Additive for urethane foams

A smaller, more uniform cell structure which improves the appearance of flexible urethane foams, is obtained with EF-4527, a silicone additive available from Dow Corning Corp., Midland, Mich.

The material is an oil-in-water 50% emulsion of silicone fluid and may be dispersed into a wide variety of commonly used catalysts; it is claimed to remain uniformly dispersed for as long as two weeks. Only one part per hundred parts of prepolymer is required for most flexible urethane foams, according to Dow Corning.

Specialty plasticizers

Abcoflex A and B specialty plasticizers, said to possess strong solvency characteristics for PVC resins, good resistance to soapy water, and low migration characteristics, are being offered by Abco Chemical Co., 68 Fleet St., Jersey City 6, N. J.

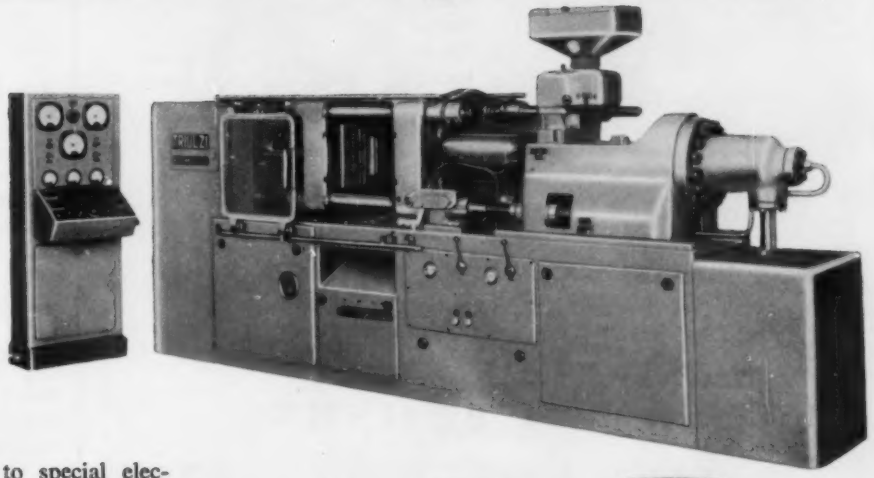
The plasticizers are clear, viscous resins with low volatility. Their main applications are expected to be in PVC resin formulations, as processing stabilizers for preparing vinyl foam, and in acrylic-type coatings which require permanence, non-extractability, and ultra-violet resistance.

Transparent PVC plate

The same wide range of chemical resistance and tough physical characteristics as in conventional opaque unplasticized PVC is claimed for a transparent vinyl plate introduced by Kaykor Industries Div., Kaye-Tex Mfg. Corp., Yardville, N. J. It is formulated for applications requiring both corrosion resistance and

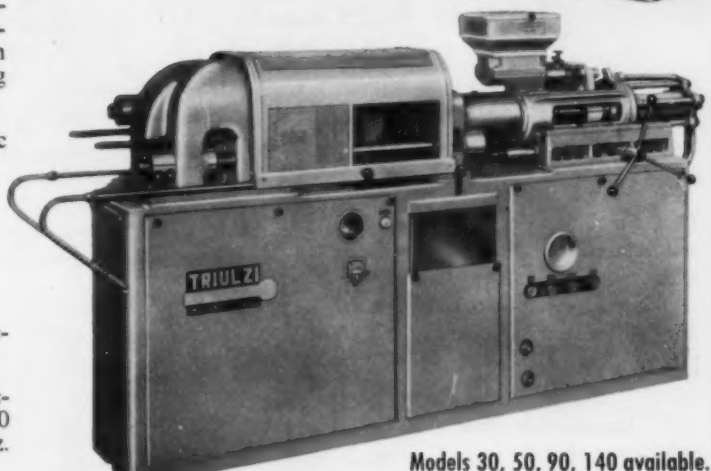
TRIULZI *Plastmatic*

Injection Molding Machines



Models 200, 300, 600 available.
Capacities, 7 to 21 oz.

- **Fully Automatic**
- **Fast-Cycling**—thanks to special electronic controls and heating cylinders which make possible an exceptional number of molding cycles.
- **Easy to operate**—thanks to hydraulic adjustment.
- **Self-Contained**
- **Ruggedly Built**
- **Horizontal and Vertical**
- **Special Safety Devices**—including a device to safeguard the molds.
- **Wide Range of Machines**—with injection capacities from ¼ oz. to 350 oz. (Model PL 6/10, with 350 oz. capacity, is Europe's largest.)



Models 30, 50, 90, 140 available.
Capacities, 1 to 5 oz.

Triulzi's Full Line of Fine Machines Includes—

Compression and Transfer Molding Presses
(hydraulic, self-contained, with automatic dosing devices)
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Presses for Rubber and Plastics Laminates
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HOW TO GET FINISHES LIKE THESE *for pennies*

For just pennies you can put brilliant, metallic finishes on plastic parts with a CEC vacuum coater.

Extra profits for molders

Since the equipment is easy to operate and relatively inexpensive, you can make vacuum metallizing one of your regular services. You can deliver the finished product, and earn an added profit.

A low-cost coater for small but fast runs

The CEC 30-inch coater (shown right) offers you a way to get into vacuum coating with a small capital investment.

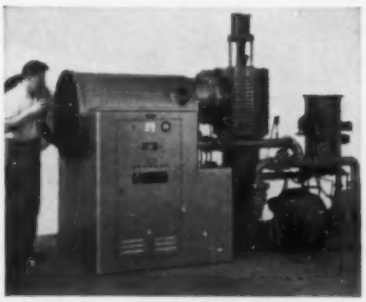
It costs only $8,975.00, F.O.B. Rochester, N. Y.

With it, you can easily coat 400 pieces 1½" in diameter per cycle. A minimum of training enables a new operator to complete four to six cycles an hour.

New lacquers make finishes more durable

Vacuum coatings on exposed surfaces are always protected by a lacquer; there are many new lacquers which can make the finish wear as well as, or even better than, many electroplatings.

We'll be glad to send you more information on CEC coaters, with a bulletin on available lacquers.



Unskilled help can produce finishes like those shown above with this CEC LCI-30 vacuum coater.

Consolidated Electrodynamics
Rochester Division, Rochester 3, N. Y.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

The Plastiscope

light transmission, and is expected to be particularly useful in the manufacture of such equipment as laboratory hoods and small plating tanks.

The material is available in clear yellow and emerald green.

Simulates marble tile

Wall tile which has the appearance of natural marble and is made from a special styrene formulation supplied by Monsanto Chemical Co.'s Plastics Div. has been introduced by Majestic Tile Co., 1647 W. Carroll Ave., Chicago 12, Ill.

Reinforced plastics

Reinforcing mat. Famco-Fiber, a fibrous glass reinforcing mat possessing good uniformity through the use of the company's continuous glass fibers, is being manufactured by Famco, Inc., 6200 Strawberry Lane, Louisville 9, Ky. Another feature of the mat is uniformity of binder content. Polyester, melamine, and thermosetting acrylic binders are used, and variation in binder content is held to 1% across the face of the mat. Silane finish assures a high wet-strength factor.

The mats are available in weights of ¼ to 2 oz./sq. ft. in increments of ¼ oz.; they come in rolls 125 ft. long and up to 72 in. wide.

Rods and tubes in large diameter. A process for the economical production of reinforced plastics rods and tubes up to 8 ft. long, with diameters up to 8 in., and in any wall thickness, has been developed by Plasteco, Inc., Houston, Texas, manufacturer of dome-type acrylic skylights. Lengths up to 40 ft. can also be produced if ordered in sufficiently large quantities. This development opens up the possibility of using reinforced plastics for such applications as propeller or agitator shafts.

The product is claimed to be superior to molded rods and tubes with respect to tensile strength,

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Baskets for automatic washers
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Laundry hampers
Kitchen containers
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Sinks
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Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
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Structural panels for offices and homes
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Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

COUNTLESS products benefit from the combination of beauty and durability Pittsburgh SELECTRON Polyester Resins can give—and usually at reduced manufacturing costs.

SELECTRON Resins are used in products ranging from truck panels that withstand extreme hot and cold, rain, snow, and sleet to television cabinets that serve as focal points of beauty in homes everywhere.

SELECTRON Resins are thermo-setting polyesters which are available in consistency from a thin syrup to extremely high viscosity. They polymerize to form solids, with or without heat and with or without pressure.

When combined with such fillers as fiber glass, cotton, rayon, nylon, felt, sisal, paper, etc., SELECTRON Resins provide a new kind of material that is lighter than aluminum, yet—weight for weight—is stronger than steel. This material has great impact resistance and withstands the deteriorating influence of weather, sunlight, heat, abrasion and many chemicals. It can be molded in durable colors.

Parts in which SELECTRON Resins are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fillers for casting, potting and impregnating.

Investigate the advantages of SELECTRON Resins that may make your products better looking, stronger and more durable. We'll be glad to have one of our engineers discuss your problems with you without cost or obligation. Such a visit may point the way to important production economies and added sales appeal.

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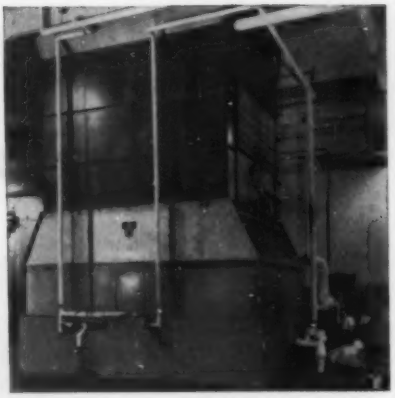

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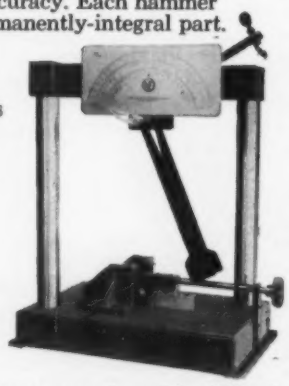
NF impact tester

The machine that makes the Izod (cantilever beam) or Charpy (simple beam) test on each of three capacity ranges. Separate hammer for each test in each capacity range (6 hammers in all). Hammers are interchangeable. Individual calibration of each hammer assures accuracy. Each hammer is one welded unit striking bit—a permanently-integral part. Possibility of variable errors due to energy absorption by screwed-on weights and detachable bits is eliminated. Attachment of hammers is at point of suspension minimizing any effect of looseness.



FEATURES:
- Three energy scales:
  0—30 foot-pounds by .2 ft.-lb.
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  0— 2 foot-pounds by .01 ft.-lb.
- Combined Izod and Charpy
- Massive open frame construction
- Individually calibrated hammers—no separate weights
- Long, open linear energy scales
- Conforms to federal specification LP 406a... and ASTM St. D 256

SAVE MONEY! Buy only hammer for type and range presently needed; additional hammers may be ordered later.

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The Plastiscope

compressive strength, and water absorption. The company states that tubes have been produced to withstand 10,000 p.s.i. external pressure at 300° F.

Resins used by Plasteco include epoxies, polyester, phenolics, and diallyl phthalate. Reinforcements may be of glass, cotton, Dacron, nylon, Orlon, or paper, according to the firm.

New entry. Modular Molding Corp., Burlington, N. J., has been formed for the manufacture of modular panels for interior and exterior walls. Materials used include fibrous glass, aluminum, or special veneer faces bonded to various types of honeycomb or foam cores. Panels will be made to customer specifications.

The company also produces corrugated glass-reinforced plastics building panels in standard widths and lengths, flat glazing panels in standard window pane sizes, and sheets up to 120 in. long. Custom molded reinforced plastics products using polyester, epoxy, foam, and premix materials, will also be manufactured.

A. R. Pollack, formerly with Strick Plastics, is president.

Expansion

Auburn Plastics, Inc., Auburn, N. Y., has acquired **Norton Laboratories, Inc.**, Lockport, N. Y., compression molder. All of Auburn's compression molding will be done at the Norton plant.

John H. Woodruff, president of Auburn, which was founded in 1876, states that this consolidation of compression molding production at Norton was necessitated by the decline in demand for custom-molded thermosetting parts brought about by improvements in the properties of thermoplastics. Combining the two plants is expected to restore operations to a profitable level.

Auburn manufactures plastics components for automobiles, business machines, and general industry by compression, transfer, and injection molding; automatic ro-

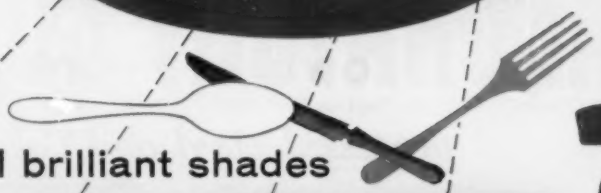
HARSHAW

Cadmium Lithopone

YELLOWS

and

REDS



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For colorful products in rich deep tones or delicate pastel tints, use Harshaw cadmium pigments.

The chemical and heat resistance of cadmium yellows and reds combined with their complete insolubility make them excellent for use in plastics, printing inks and industrial finishes.

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Why are so many molding and extruding plants buying

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processed vinyl and polyethylene?

Because they're saving money. Our processed vinyl and polyethylene DO cost less, but at the same time, precise laboratory control assures a product of the highest quality. Working with modern methods and machines, we are able to fill your raw material orders to EXACT specifications, at definite savings to you. HOW?

We maintain complete laboratory equipment of the very latest type, and a staff of highly skilled technicians checks the quality of vinyl and polyethylene we buy, then keeps a constant watch on our processing. Whether you do molding or extruding, we are in a position to handle your requirements . . . just let us know what product you make and give us your specifications.

There is NO GUESSWORK involved — and it COSTS YOU LESS.

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tary molding; and extrusion of sheets, tubes, rods, and various profiles. The firm also produces vinyl compounds and plastisols.

Reed-Prentice, recently consolidated as a division of **Package Machinery Co.,** is expanding its production of plastics machinery and moving the firm's entire operation from Worcester to the East Longmeadow, Mass., plant of the parent company. The transfer is expected to be completed by June 1.

Reed-Prentice is reported to manufacture 30% of the 2.5- to 35-oz. injection machines used by the American market; Package Machinery is a leading manufacturer of wrapping and packaging equipment. The combined companies maintain 17 branch offices and have sales representatives throughout the United States and principal foreign capitals.

Iver G. Freeman was elected vice president in charge of research and development programs for **Reed-Prentice Div.; J. Joseph Kelly,** vice president—sales; and **Edward W. Forth,** vice president in charge of machine tool activities.

L.O.F. Glass Fibers Co. is erecting a plant in Corona, Calif., costing over $1 million, for the manufacture, fabrication, and warehousing of the firm's line of insulation products, including its recently introduced pipe insulation. The fabrication work now done at Burbank, Calif., will be moved to Corona when the plant has been completed.

The new structure, scheduled for completion August 1, will provide an area of 105,000 sq. ft., of which 5000 will be for office space. It will employ about 300 persons.

Columbus Plastics Products, Inc., manufacturer of plastics housewares, is constructing a 110,000-sq. ft. building on a site adjoining its present plant at 1625 W. Mound St., Columbus, Ohio. Newer and larger presses and the additional floor space will greatly expand

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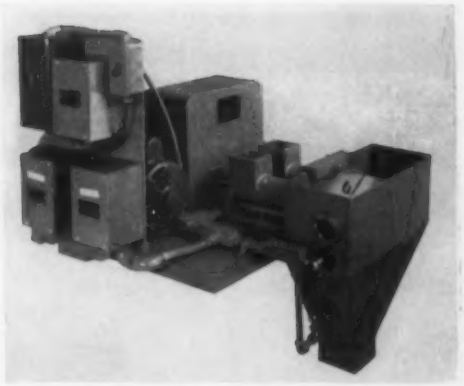
New Color Proportioner 129



anti-wrinkle slat expanders
spooling machines
color proportioners
rigid pipe pull offs
film take-up units
cut-off reels and slitters
film rewinders

EXTRUSION AND INJECTION PLASTICS MOLDERS get greater operating economy and stepped up production with Progressive's Color Proportioner 129. This unit accurately adds a controlled amount of color concentrate to clear or neutral plastic base compounds. Result is a uniform blend mixed in one continuous automatic operation. And production is up to 2000 pounds per hour!

Installation of the Color Proportioner 129 provides still another important advantage. It eliminates the necessity of tying up valuable floor space with large inventories of *prepared* raw materials in numerous colors. Only a supply of color concentrate and clear or neutral plastic base materials is required. *To see how you can save, write for full details today!*

Progressive machine co., inc.

Specialists in Plastic Film Handling Equipment

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Many of the cutting problems that have faced the plastics industry such as freezing, expansion, cracking, burning and chipping have been solved with this unique design.

Blade is available with hollow grind for special applications.

Find out about the most advanced blade in the industry. Write today!

FORREST MFG. CO., INC.
233 Highway 17, Rutherford, N. J.

The Plastiscope

present facilities for molding and finishing operations, permitting use of the latest improved plastics materials for larger molded housewares items.

In celebrating its 20th anniversary, the company announces that its expansion program in excess of $1 million will be completed during 1958.

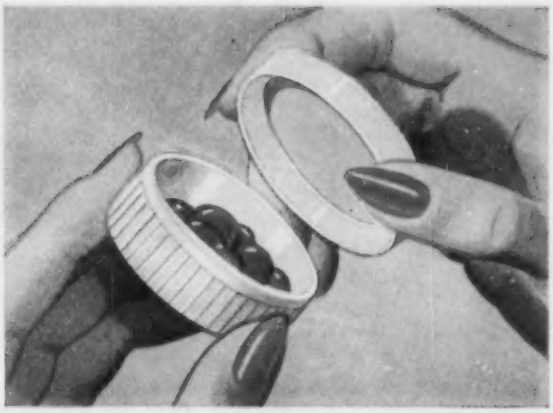
Emery Industries, Inc. has acquired the **Vopcolene Div. of Vegetable Oil Products Co.**, Los Angeles, Calif., producer of a diversified line of fatty acids. The division will be operated as the **Vopcolene Div. of Emery Industries, Inc.**, which will remain under the direction of **Carl Williams**, general manager. The parent company plans substantial expenditures for expansion and improvement of the production facilities.

This is the third expansion by Emery in the past two years. The firm had previously acquired the fatty acid manufacturing facilities of S. F. Lawrason & Co., Ltd., London, Ont., and formed a multi-million-dollar joint venture with **Monsanto Chemical Co.** involving the construction of a new plant at Nitro, W. Va., to fractionate tall oil into rosin and fatty acids. These expansions and the acquisition of Vopcolene put Emery into a position to market a complete line of fatty acids and organic chemical derivatives throughout the United States and Canada.

Shaw Insulator Co., Irvington, N. J., has added 6000 sq. ft. of floor space to its new plant in Stroudsburg, Pa. The new facilities are geared for the production of thermosetting plastic parts for the appliance, automotive, aircraft, and communication industries. Shaw is a custom molder and is equipped for transfer, compression, and injection molding.

Crofton, Inc., subsidiary of **Crofton Mfg. Co.**, Grand Rapids, Mich., has established a fabricating and distributing operation

Easy to use . . .
Customer simply lifts off



Convenient . . .
and fits together again

Designed for pocket or purse . . .
Sized just right for day's supply of tablets or capsules

O-I's new Pocket-Pak

. . . adds Premium Appeal to your salespackage!

This plastic carrying case, offered exclusively by Owens-Illinois, is a packaging idea that has a special appeal to customers.

It's a premium. And it's everything a successful premium should be: it has eye appeal and obvious value . . . it is functional . . . it is a good-will builder . . . and, as long as it is used, it serves as a favorable reminder of your company and your products.

The new Pocket-Pak can be personalized with your brand name at a nominal cost, for added impact.

Ask your Owens-Illinois representative to show you this newest of packaging ideas . . . another sales-building benefit for you from Owens-Illinois.

Call him today!

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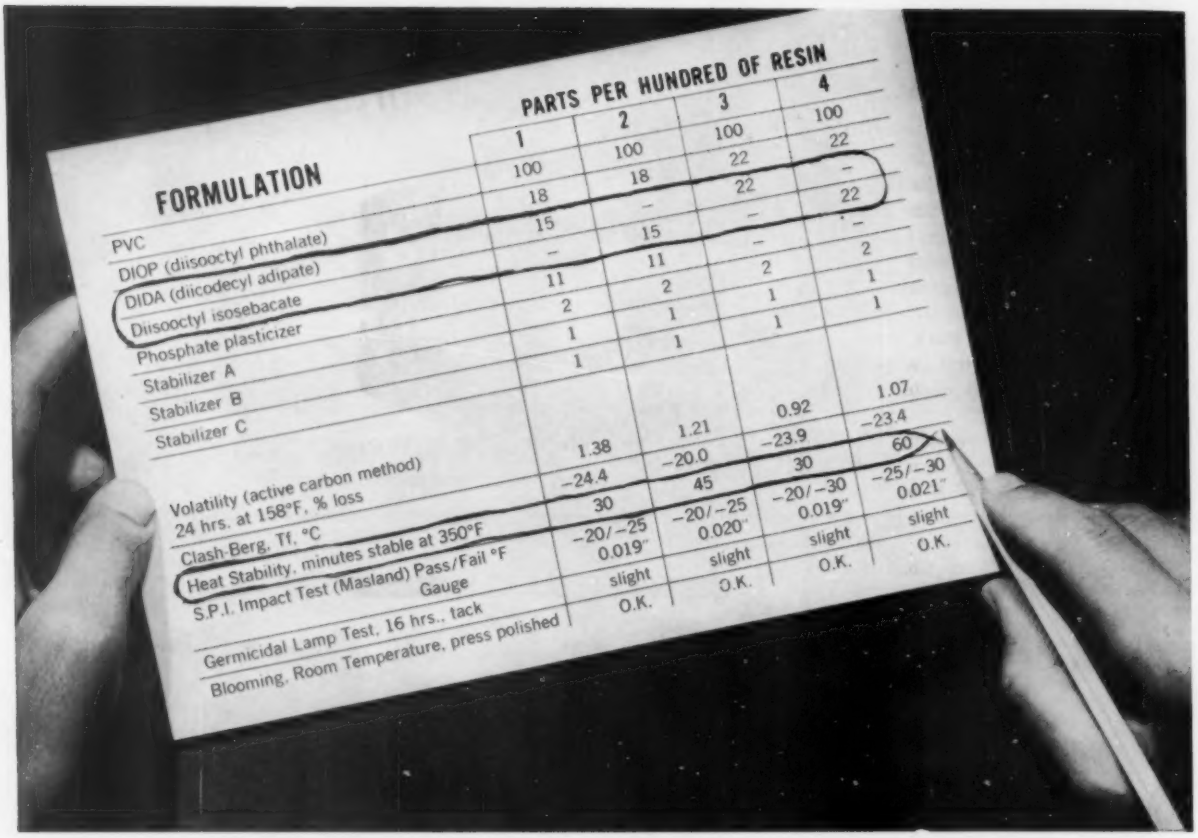


This test shows

HEAT STABILITY OF PLASTICIZED VINYLS IS IMPROVED BY ESTERS OF ISOSEBACIC® ACID

ISOSEBACIC® acid, a new synthetic 10-carbon dibasic acid, has many plus values that recommend it as an intermediate for vinyl plasticizers. You'll see one example in the above figures—results of a test made recently by a processor of vinyl plastic film.

Read down columns 1 and 2. *Heat stability improves 50%* (from 30 minutes to 45 minutes) when 15 parts of an ISOSEBACIC acid ester replace 15 parts of an adipic ester in this formulation.

Read down columns 3 and 4 and you see an even more striking result in a test where higher ester levels were used. ISOSEBACIC acid ester actually *improves heat stability 100%* (from 30 minutes to 60 minutes).

Among the plus properties of ISOSEBACIC acid esters as vinyl plasticizers are:

- Low color
- Low odor
- Low oil extraction
- Low soapy water extraction

And ISOSEBACIC acid has other uses in the plastics field. It can be used as an intermediate for polyamides, polyesters, polyurethanes and alkyd resins. If you make any one of them—or a vinyl plasticizer—it will pay you to evaluate U.S.I. ISOSEBACIC acid. Send today for data sheets and samples.

CHEMICAL PROPERTIES

ISOSEBACIC acid is a mixture of C-10 dibasic acids—2-ethyl suberic; 2,5-diethyl adipic; and sebacic. It undergoes typical reactions of dibasic acids. It yields acid and neutral esters, acid and neutral salts. Relatively stable, it is not oxidized by air at ordinary temperatures.

PHYSICAL PROPERTIES

Molecular weight	202.24
Combining weight	101.12
Density (80°C)	1.025 g/ml 8.55 #/gal
Melt viscosity (80°C)	78.5 centipoises
Specific heat of vapor (226°C)	0.34 cal/g (est.)
Heat of vaporization (226°C)	107 cal/g
Specific heat of solid (24°C)	0.33 cal/g
Heat of Combustion	1296 K cal/mole
Flash point (closed cup)	430°F.
Ionization constant at 25°C	$K_1 = 3.5 \times 10^{-5}$ $K_2 = 5.1 \times 10^{-6}$

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

which will serve Indiana, Kentucky, and Ohio, in the sale and distribution of Polyfoam, a polyether-based urethane foam developed by **The General Tire & Rubber Co.** The Polyfoam operation will be housed in a 40,000-sq. ft. building at Park and Jeffras Sts., Marion, Ind., which will serve as sales headquarters, plant, and warehouse.

Robert McKeon appointed general plant manager and **Donald Cory** and **William Brown** sales representatives.

Molded Fiber Glass Co., Ashtabula, Ohio, has purchased equipment and inventories of the **Fiberglass Reinforced Plastic Molding Div. of American Hard Rubber Co.,** Akron, Ohio, and will also take over production of the fibrous glass reinforced plastics parts formerly custom molded by American Hard Rubber.

This is the second major expansion since 1956 for the Ashtabula firm, which last year increased its molding capacity by 50 percent.

Lawter Chemicals, Inc., 3550 Touhy Ave., Chicago 45, Ill., has purchased **Krumbhaar Chemicals, Inc.,** 24-30 Jacobus Ave., S. Kearny, N. J., manufacturer of synthetic resins, pure phenolics, and specialty resins. Krumbhaar will continue to operate under the same name, with **William Manko** as vice president in charge of Krumbhaar operations.

The acquisition will enable Lawter, with its multi-plant production of alkyd resins, printing ink vehicles, and fluorescent products, to expand sales operations in those allied fields currently serviced by Krumbhaar. Lawter's manufacturing operations are conducted at plants in Chicago, Ill.; Newark, N. J.; and San Leandro, Calif.

The National Plastics Products Co., Odenton, Md., has broken ground for a warehouse and office facilities in Long Beach, Calif. The 35,000-sq. ft. structure will

Apart from a full line of Temperature CONTROLLERS

users have proved *these* instruments by WEST

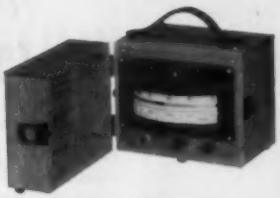
MODEL I SERIES

High Resistance indicating pyrometers

Complete Control Systems handily centralizing instruments

MODEL RT SERIES

Resistance Thermometer indicators (and controllers)



MODEL IE SERIES

Portable high resistance indicators

MODEL IN SERIES

Multi-Point indicators with TC switches

MODEL M SERIES

tubeless electronic potentiometer strip chart Recorder

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—designed to give better protection from heat and light. Whether you are producing film, sheeting, floor tile or plastisols, there is a Metasap Stabilizer to do the job.

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—these proven compounds not only improve internal lubrication of mold powders, but act as plasticizers. When dusted on molds, they supply external lubrication and prevent sticking. They also permit molding at lower pressures, help speed the molding cycle, promote longer mold life, improve the finish of the end product.

Our skill in the manufacture of these compounds is complemented by our nationwide distribution facilities.

So remember, whatever your needs, you will fill them best—fill them fast—through Metasap. Write for full information. Our Technical Service Department will gladly make recommendations based upon your specific requests. Metasap Chemical Company, Harrison, N.J.

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VITAL INGREDIENTS FOR THE PLASTICS INDUSTRY

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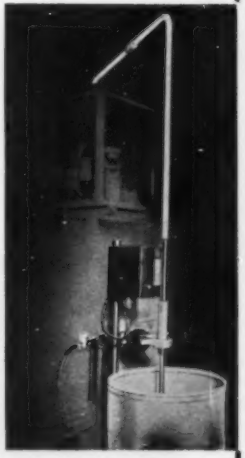
WHITLOCK automatic DRYER

Dehumidifies Air to a Minus 20 Dew Point

The Whitlock dryer works on the principle of a closed system using dehumidified air of minus 20 dew point. This gives you complete control of humidity in the drying air regardless of room air humidity. This means faster and more thorough drying of the plastic material to a predetermined temperature. The Whitlock dryer will handle nearly every type of plastic material. The capacity varies with the type of plastics being dried. Write for complete details.



Automatic HOPPER LOADERS

For All Plastic Materials

Whitlock loaders transfer all thermosetting and thermoplastic material from floor level to your hoppers. Our filter cone attachment and new suction intake tube (available for all models) make it easy to transfer all dry colored and fine powder plastics *without creating a cloud of dust.* The suction intake tube automatically pulls itself into the material. All models operate from your plant air supply—various sizes are available with rated capacities up to 2,000 pounds per hour.

But that's not all—Whitlock loaders are self-supporting units—No attachments to the machine required. You can place the units wherever you desire—Many units are installed as much as 100 feet from the machine.

Write or phone today for complete specifications

WHITLOCK ASSOCIATES, INC.

21657 Coolidge Highway, Oak Park 37, Mich. TEL. LIncoln 6-7266

The Plastiscope

serve as headquarters for the firm's Western Div. which services 11 western states, Hawaii, and Alaska. The company's products include Nevamar high-pressure laminates, saran and nylon filaments, and a variety of extruded and molded plastic products.

The C. P. Hall Co. of Illinois is constructing a 21,000-sq. ft. office building and warehouse at 5245 W. 73rd St., Chicago, Ill. Its present building at 5145 W. 67th St., Chicago, will be converted to manufacture. Additional equipment will be installed to increase the production capacity of esters, plasticizers, surface active agents, and defoamers. Existing research laboratory facilities will be enlarged to include technical service.

Paramount Packaging Corp., 3111 W. Allegheny Ave., Philadelphia, Pa., has acquired the **Flexible Packaging Div. of Container Corp. of America,** Chicago, Ill. Designated Plant No. 3, the new **Chicago Div. of Paramount** will be under the general management of **Irvin Isen,** vice president, and **Joseph Gauss,** sales manager.

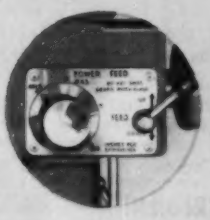
This acquisition makes Paramount a highly diversified packaging entity, with complete facilities to furnish multi-colored rotogravure, letterpress, and flexographic printing on polyethlene, Mylar, Pliofilm, acetate, cellophane, paper, and foil. The company can also convert these materials into printed rolls, bags, sheets, envelopes, and pouches.

Architectural Plastics Corp., Eugene, Ore., has formed a new division, **Architectural Plastics International,** to extend to other countries its engineering, development, and marketing services for plastics building materials and processes. In countries with inadequate productivity in these materials, the company will assist in the development and orientation of such productivity. The firm is particularly interested in the

meet 1-D ..newest member of the CINCINNATI TOOLMASTER Family

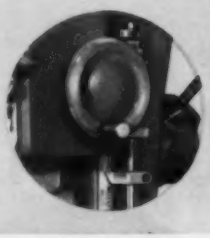
New CINCINNATI No. 1D Toolmaster Milling Machine. Catalog No. M-2017. Other styles: 1A, 1B and 1C; catalog No. M-1870-4.

Spindle speeds are changed instantly. Merely select the high or low range and then rotate this control lever to the speed desired. Speeds are dial indicated.



For boring and drilling operations, you'll want power feed to quill, at slight extra cost. Three feed rates; knob selected; up and down; .0015", .003" and .006" per rev.

Quill feed handwheel, mounted on front of the spindle head, advances the quill in fine feed progression. A lever on the right-hand side quickly advances or retracts the quill.



Hundreds of CINCINNATI Toolmaster Milling Machines — the familiar 1A, 1B and 1C styles — are giving an excellent account of themselves in shops throughout the country. And now the new 1D Toolmaster extends the versatility of this fine family of machine tools still further. Exclusive 1D features and advantages include:

Infinitely variable spindle speeds, 100-3800 rpm

Instant selection of spindle speeds . . . through a control lever on front of the spindle head

1½ hp spindle drive . . . and it's all usable

No. 40 standard taper hole in spindle . . . and positive key drive for arbors and collets

Power quill feed (extra) . . . up and down; three feed rates; power trip-out

These and other features and advantages give 1D Toolmasters the highest performance rating for reducing the cost of vertical and angular milling operations, and, with additional equipment, boring and shaping operations as well. Now's the time to replace your worn out ¾ to 1½ hp milling machines with new CINCINNATI Toolmasters. Complete information in attractive catalogs. May we send copies to you?

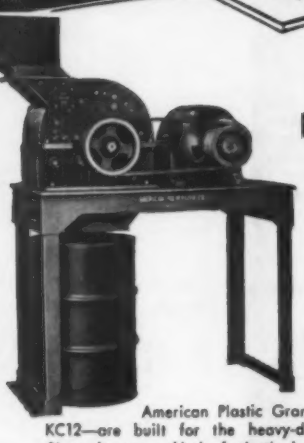
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI®

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • SPECIAL MACHINE TOOLS • METAL FORMING MACHINES HARDENING MACHINES • CUTTING FLUIDS • GRINDING WHEELS

PLASTIC MANUFACTURER REDUCES 200,000 LBS. OF PLASTIC SCRAP YEARLY with this

AMERICAN
ROTARY KNIFE
PLASTIC GRANULATOR



IN USE EVERY DAY . . . 6 DAYS A WEEK!

In the past year, this American KC-9 Rotary Knife Plastic Granulator, installed at a large St. Louis plastic molding company, has regranulated over 200,000 pounds of plastic scrap to a homogenous granulation . . . at a rate of up to 1500 lbs. per day. (Short scrap is being run through at an average of 300 lbs. per hour.)

American Plastic Granulators—available in two sizes, KC9 and KC12—are built for the heavy-duty demands of constant, tough usage. Size, shape, or kind of plastic is no problem for this sturdy machine. The clean, shearing action of the adjustable rotary cutter blades of fine tool steel, provide fast, once-through regranulation.

Write for your copy of "GRINDING PLASTIC SCRAP PROFITABLY"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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WE BUY AND SELL VIRGIN AND REPROCESSED MOLDING POWDERS

We carry a large inventory of all types of thermoplastic scrap and virgin molding powders.

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POLYETHELENE • POLYSTYRENE
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New York, New York

The Plastiscope

overseas potential for sandwich, shell, and panel structures in many plastics media.

The production processes for translucent sandwich structures developed by an APC subsidiary, **Design Industries,** will be made available under this program.

Pittsburgh Plate Glass Co., Paint and Brush Div., has completed and placed into full-scale production Selectron polyester resin manufacturing facilities adjoining its paint-producing plant at Torrance, Calif.

The new single-production unit will provide the firm's West Coast customers with faster service and facilities for handling bulk shipments.

Consolidated Molded Products Corp. has opened a new 80,000-sq. ft. injection molding plant at Greenwood Ave. and Warner St., Scranton, Pa. Plant equipment includes 23 injection machines, as well as spray painting, metallizing, and other decorating and finishing facilities. The new plant also houses the firm's proprietary sales offices and showrooms.

Chemical Process Co., 2800 Russ Building, San Francisco, Calif., has completed the construction of expanded facilities for the manufacture of DION resinous adhesives at its Redwood City, Calif., plant. These adhesives are used in the manufacture of plywood and other forest products.

Industrial Plastic Fittings Co., 3891 W. 150th St., Cleveland 11, Ohio, has purchased the complete set of tooling for producing SWP size solvent-welding type plastic fittings from **Mills Plastic Div., Continental Can Co.** The purchase includes a large inventory of fittings in both butyrate and Kralastic in sizes ½ through 4 inches.

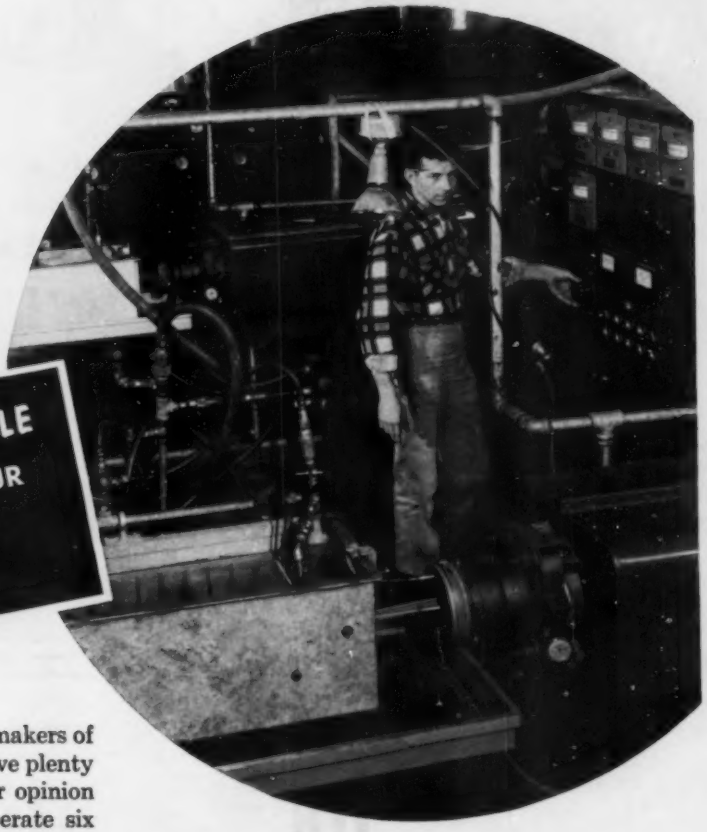
Lone Star Plastics Co., Inc., Fort Worth, Texas, research engineering and custom manufacturing plastics firm, has doubled the ca-

Here's what TEXAS PLASTIC PRODUCTS CO.

think of their

NRM

Thermoplastics EXTRUDERS



"DEPENDABLE . . . VERSATILE plus HIGH POUNDS PER HOUR EXTRUSION WITH ALMOST NO MAINTENANCE" . . .

TEXAS PLASTIC PRODUCTS CO., makers of *Tex-Trude* Custom Thermoplastics, have plenty of experience upon which to base their opinion of NRM Plastics Extruders. They operate six NRM's in their Houston, Texas plant, extruding a wide variety of formulations to meet a wide range of trade requirements for their popular *Tex-Trude* products.

In discussing their work with NRM Extruders, C. M. Nettles, Plant Manager of Texas Plastic Products Co. said: "Typical of NRM dependability is the fact that one of our machines has operated twelve hours a day for over six years, yet has required almost no maintenance. We're sure, too, that because of many advanced design and operating features, our NRM machines will stay modern, competitive and profitable to the Company for years. They have contributed a large part in the growth and success of our firm."

The advanced design and operating features referred to above are things like NRM's "Balanced Heat Control," long cylinder ratios, quick-opening die gates, patented feed screw types and corrosion-resistant construction. They're mighty important, but they're only a *few* of the many advantages that make NRM Extruders "preferred for greater profit" by plastics producers the world over. Send for more details, and "go NRM" the next time *you* purchase plastics extruders and equipment.

2930

NATIONAL RUBBER MACHINERY COMPANY

NRM

Creative Engineering

General Offices and Engineering Laboratories: 47 West Exchange St., Akron 8, Ohio
EASTERN PLANT: 384 Getty Ave., Clifton, N. J.
SOUTH: The Robertson Company, Rutland Building, Decatur, Ga.
WEST: S. M. Kipp, Box 441, Pasadena 18, Cal.
MID-WEST: National Rubber Machinery Company, 5875 N. Lincoln Ave., Chicago 45, Ill.
CANADIAN: F. F. Barber Machinery, Ltd., 187 Fleet St., West, Toronto, Ont.
EXPORT: Omni Products Corporation, 460 Fourth Ave., New York, N. Y.

Revell ships and planes will take you all over the Continent

IF YOU KNOW plastics, you know Revell. Half of all the hobby kits made in America are Revell kits. If you also know Europe, you may know that Revell sells half of all kits there too... *only three years after entering the European market!*

Are you the man who can help to implement our program of *further* international growth? We must obtain complex plastic injection molds from a variety of European sources. If you can initiate and supervise that entire mold-making and development program, Revell offers you a top-management position with salary to match.

Our Chief Engineer for Europe must speak and write technical English clearly. No formal university training is necessary, but his experience must include several years of mold-making and tool-shop supervision. He should know drafting, tool design, engineering office administration, and of course be intimate with European business practices. He may now be working anywhere in the world.

After learning our company's procedures and plans, this engineer will set up headquarters in London or Germany and travel throughout the Continent—first to select the tool shops to make our molds, and then to supervise their exacting work.

* * * *

INTERESTED? WRITE, GIVING DETAILS OF YOUR EXPERIENCE AND BACKGROUND, TO: *Mr. Charles Gretz, Vice-President in Charge of Engineering, at either Revell, Inc., 4223 Glencoe, Venice, California, U.S.A., or Revell, Ltd., 25/27 Berners Street, London W. 1, England.*

To Mold-Making Firms in Europe:

For an opportunity to grow with Revell by making molds for us, write the Engineering Supervisor at our California or London address. Please describe your shops' equipment, capacity, and experience.

Revell
Authentic Kits

pacity of its plant by remodeling it and increasing facilities from 7000 to 10,000 sq. feet. The company now produces a variety of industrial plastics parts for electronics, aircraft, and oil well manufacturers.

Plastic Art Metallizing Corp., 68 Freeman St., Brooklyn 22, N. Y., has installed a 72-in. vacuum metallizing unit and will now process plastics, metals, and glass in production runs on items up to 22 in. in diameter. The company has also combined its operations with the custom silk screening and hot stamping formerly offered by **Plastic Art Decorating Co.** at the same address.

Raritan Plastics Corp., 1 Erie St., Paterson 4, N. J., has added to its production facilities with the installation of a 4½-in. extruder. The company manufactures polystyrene, Cycolac, and polyethylene sheets and rolls.

Deceased

Russell H. Dunham, first president and chairman of the board of **Hercules Powder Co., Inc.**, Wilmington, Del., died suddenly on February 1. He was active in company affairs for 44 years. Mr. Dunham retired as president in 1939, remaining as chairman of the board of directors until 1944; he continued as chairman of the company's finance committee until 1952, and remained as a director of Hercules until 1956.

Lee A. Keane, 63, retired vice president of **U. S. Industrial Chemical Co., Div. of National Distillers & Chemical Corp.**, died on February 7. Until his retirement in November 1956, Mr. Keane had been vice president—sales for 20 years.

Meetings

Plastics group

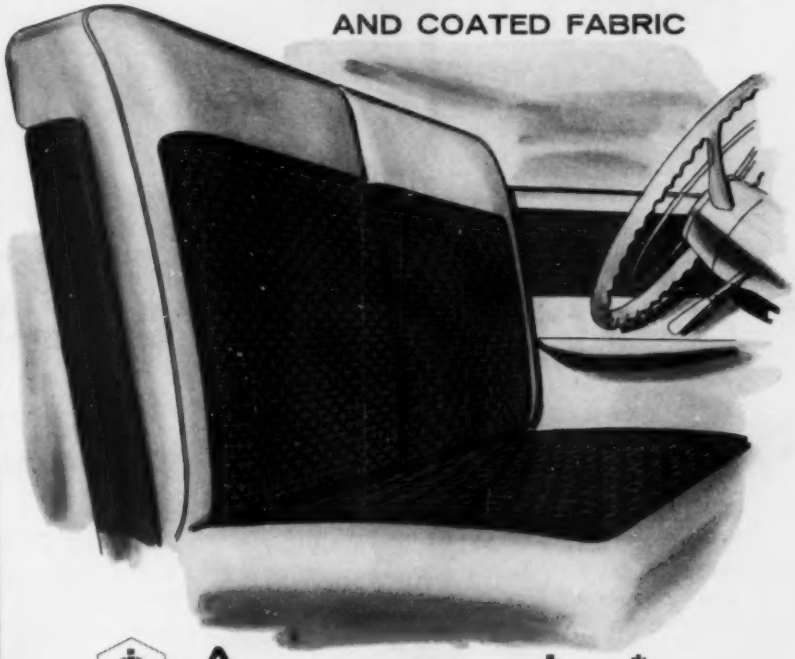
April 28-29: The Society of the Plastics Industry Canada, Inc., Sixteenth Annual S.P.I. Canadian

(*To page* 258)

NOW! LASTING

Brilliance

ON VINYL FILM, SHEETING AND COATED FABRIC



Auravin*

PERMANENT METALLIC COLORS

At last! A dynamic decorating approach to *lasting* brilliance on vinyl film, sheeting and coated fabric! It's Interchemical's package-stable line of *permanent, non-tarnishing, ready-mixed* metallic colors! IC Auravin Colors provide the vinyl converter with a proven tool for producing long-lasting and striking decorative effects for luggage, wall coverings, automobile and furniture upholstery and many other applications. They range in shade from metallic pastels to pale green golds, to rich red golds and coppers. Topping with IC vinyl clears increases their brilliance and depth of shade.

Considerable exposure to light, heat, hydrogen sulphide fumes, and perspiration produce neither tarnishing nor change in color! IC Auravin Colors may be applied by conventional gravure printing or by knife-coating techniques.

Provide a bright future for *your* vinyls. Consult your nearest IC Vinyl Ink Specialist for further details on IC Auravin Colors.

Interchemical
CORPORATION
Finishes Division

Headquarters Office: 224 McWhorter St., Newark 5, N. J. Factories: Chicago, Ill. • Cincinnati, Ohio • Elizabeth, N. J. • Los Angeles, Cal. • Newark, N. J. • Mexico City, Mex. In Canada, this product is made by Aulcraft Paints Limited, Toronto, Ontario, and sold under its trademark. **IC and Auravin are trademarks of Interchemical Corporation.*

Got a plastics problem?

Get the facts - and get them fast in your Encyclopedia Issue

Take these two typical "help-in-a-hurry" examples:

1. Which Plastic to Use? "Because our products have a variety of end-use requirements, our problem is always the same—which plastic to use?

"To solve this problem, we first consult the *Plastics Properties Chart* facing page 554. This shows us comparative processing qualities; physical, thermal and electrical properties; the materials' reaction to chemicals, and even trade designations and manufacturers.

"Next we turn to the *Resins and Molding Compounds* section, starting on page 40. There we get full information on how the materials should be handled, what their features are, and what their specific product applications should be.

"The fact that a section of pertinent advertising adjoins each editorial division is also most helpful."—Major Electrical Products Manufacturer.

2. How to Fabricate? "We were experimenting with a die cutting job on a heavy sheet of vinyl. Soon we found ourselves up to our knees in waste material.

"To beat the problem we turned to the section on *Machining Thermoplastics,* page 824. This article gave us general "how to" data on coolants, and tool design and operation; also specific recommendations on sawing, routing, drilling, turning, threading, shearing, punching and finishing.

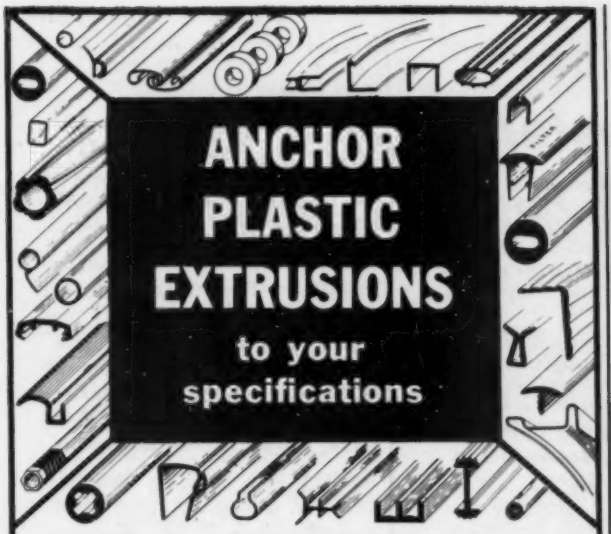
"The article was so good, in fact, that it has now been adopted as the working manual for our fabricating division."—Custom Molder.

* * *

The Encyclopedia is expressly designed to aid you in solving your day-to-day problems. Reach for it next time you need help and see how valuable it can really be!

MODERN PLASTICS ENCYCLOPEDIA ISSUE

for fast, accurate answers to plastics problems



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to your specifications

Shapes, Rods, Tubes, Fabricated Extruded Parts, Curved Extrusions*, Plasti-Metallic Trim Moldings.

- We have made more complex extrusion dies than anyone we know.
- Our 17 years' experience in custom-extrusion and fabrication is your assurance of top quality service, at minimum cost.
- No die charge for rods or tubes.
- Send us your prints for prompt quotation. *Pat.

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A New Material is Born!

ALLFAB Orlon* Mat

Smooth • Tough • Durable

Low-cost surfacing and reinforcing fabric for the Plastics Industry

ALLFAB Orlon Mat comes from a special Felters' process which combines short fibers of Orlon with a thermoplastic resin binder — producing a uniform bonded fabric at low cost.

In reinforced plastics, the combination of properties is quite unusual . . .

- High abrasion resistance
- Resists temperatures to 300°F
- Excellent surface finishing characteristics
- Resists chemicals, weathering, staining, sunlight
- Excellent electrical insulating properties
- Low moisture absorption, no fiber wicking
- Can be easily deep drawn and fabricated
- Post-formable

ALLFAB Orlon Mat offers many new and intriguing possibilities . . . as an overlay or reinforcement. It greatly improves utility and appearance of standard glass reinforced laminates—adds to strength, surface smoothness and durability.

Send for details on the new ALLFAB Orlon Mat NOW. See how its many properties can help in styling, design and performance. Write or call today.

ALLFAB Orlon Mat

A NEW MATERIAL FROM

THE FELTERS COMPANY

Manufacturers of Felt and Felt Products

216 South St., Boston 11, Mass.

*Registered trademark for duPont's acrylic fiber FE7-28

UNIQUE *asbestos fiber for phenolics, polyesters*

POWMINCO ASBESTOS

POWMINCO ASBESTOS is the *only completely fiberized acid-resistant asbestos fiber in the United States.*

Made exclusively by the Powhatan Mining Company, it is now widely used as a filler and an absorbent and extender in phenolic and polyester resins.

Proved Acid-Resistant

POWMINCO ASBESTOS, practically inert (95% insoluble), is unaffected by as much as four hours boiling in concentrated hydrochloric acid. It is this quality that gives it a distinct advantage over ordinary chrysolite fiber in molding compounds (such as phenolics) that require an acid catalyst, and in casting resins.

Because it contains so little water (it's an anhydrous magnesium silicate), unusually low shrinkage results when POWMINCO ASBESTOS is used in molding and tooling operations.

Offers Exceptional Advantages

Excellent heat resistance, very high dielectric strength and extremely low magnetic iron plus high absorption, easy "blendability" and *low cost* conclusively guarantee POWMINCO ASBESTOS as the finest filler you can buy.

For working samples (for any resin), simply write us on your letterhead. No charge or obligation.

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Complete with every up-to-date facility to provide you with faster, more economical and more efficient service.

CUSTOM
Pulverizing Plastics Center*

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Modern Plant to pulverize (sort, separate, grade, decontaminate and grind) virgin and scrap plastics (including fine grinding of linear polyethylene, polystyrene, nylon and teflon).

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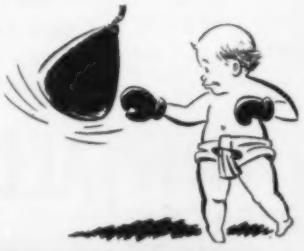
For full details of our economical custom grinding service write or telephone Columbia Pulverizing Corporation, 1180 East Broad Street, Elizabeth, N.J. Telephone: Elizabeth 4-9292.



COLUMBIA PULVERIZING CORP.

SPECIALISTS IN **PULVERIZING** *PROBLEMS*

Section Conference, Royal Connaught Hotel, Hamilton, Ont.

Other meetings

April 14-15: American Institute of Electrical Engineers, Ninth Rubber and Plastics Conference, Sheraton Mayflower Hotel, Akron, Ohio.

April 15-17: Society of Chemical Industries, Plastics and Polymer Group, Symposium on "The Physical Properties of Polymers." Additional information may be obtained from Mr. K. H. C. Bessant, The Distillers Co., Ltd., Great Burgh, Epsom, England.

April 21-22: Building Research Institute, Seventh Annual Meeting, Shoreham Hotel, Washington, D. C.

April 24-29: Salon International des Plastiques (The International Plastics Show), Oyonnax (Ain), France.

May 1-8: American Society of Tool Engineers, Annual Meeting and Tool Show, Philadelphia Convention Ctr., Philadelphia, Pa.

May 20-21: The Chemical Market Research Association, Annual Business Meeting and Open Technical Session, Hotel Statler, New York, N. Y.

May 28-29: Deutsche Gesellschaft für Chemisches Apparatewesen (DECHEMA), 2nd Congress of the European Federation of Chemical Engineering, Brussels, Belgium. (To be continued at Frankfurt am Main, Germany, May 31-June 8.)

May 31-June 8: DECHEMA, European Congress of Chemical Engineering and ACHEMA 1958 Congress, 12th Exhibition and Congress of Chemical Engineering, Frankfurt am Main, Germany.

June 9-12: American Society of Mechanical Engineers, National Conference on Materials Handling in Conjunction with the National Materials Handling Exposition, Public Auditorium, Cleveland, Ohio.

July 7-11: National Housewares Manufacturers Association, Twenty-ninth National Housewares Exhibit, Atlantic City Auditorium, Atlantic City, N. J.

Companies . . . People

Koppers Co., Inc.: David L. Eynon, Jr., former pres. of Mobay Chemical Co., has become VP and gen. mgr. of the company's newly formed **Plastics Div. T. C. Keeling, Jr.** named VP and gen. mgr. of the newly created **Chemicals and Dyestuffs Div.** He was formerly mgr. of **American Aniline Products,** a unit of Koppers. **Carl H. Pottenger,** formerly a VP in the Chemical Div., named VP, asst. gen. mgr., and mgr. of marketing for the new Plastics Div. **B. J. C. van der Hoeven,** previously VP and gen. mgr. of the Chemicals Div., now a VP in the **International Div.**

Increased activity is the reason for the new Plastics Div. as exemplified by the new high-density polyethylene plant at Port Reading, N. J., and a new expandable polystyrene plant at Kobuta, Pa. Other plants to come under Mr. Eynon's division are those at Port Arthur, Texas; Berkeley Heights, N. J.; Chicago, Ill.; and Los Angeles, Calif.

Mobay Chemical Co.: John R. Eck, formerly asst. gen. mgr. of Monsanto's Inorganic Chemicals Div., elected pres. He succeeds **D. L. Eynon, Jr.,** who has become gen. mgr. of the **Koppers Co., Inc., Plastics Div. Richard C. Burck,** named mgr. of product development. He will also supervise development projects which had been assigned to **Robert H. Kittner,** formerly dir. of development for Mobay, who has resumed a position with Monsanto Chemical Co. at St. Louis, Mo.

The Goodyear Tire & Rubber Co.: Oka Carlson appointed mgr. of the new plastics plant at Apple Grove, W. Va., which will produce Videne, the new polyester film recently announced by the company. Mr. Carlson will headquarter in Akron, Ohio, until the $9 million installation goes into production, which is expected early in 1959.

Union Carbide Corp., Bakelite Co.: Allan Brown has retired as VP—advertising after more than 38 years' service. He was a founder of The Society of the Plastics Industry, Inc. Mr. Brown's Advertising Dept. activities were taken over by **Carl W. Patton,** mgr.—advertising. **Philip G. Magnusson** appointed sales mgr., Calendering Materials. **Henry W. Greenhood** appointed western zone sales mgr., with headquarters in Chicago, Ill.

American Cyanamid Co.: Kenneth H. Klipstein and **George R. Martin,** previously VPs, promoted to newly created office of exec. VP.

Formica Corp.: Kenneth P. Pitt appointed mgr. of the eastern regional office at 199 Main St., White Plains, N. Y.

Cyanamid of Canada, Ltd., a wholly owned subsidiary, is the new name of the company formerly known as North American Cyanamid, Ltd., with new headquarters at Montreal, Que. **Dr. L. P. Moore,** formerly asst. gen. mgr. of the parent company's Plastics and Resins Div., elected pres. He succeeds **F. S. Washburn,** appointed gen. mgr. of American Cyanamid's Phosphates and Nitrogen Div.

Monsanto Chemical Co.: Dan J. Forrestal promoted from mgr. to dir.—public relations. He succeeds **Howard A. Marple** who will rejoin the company after a leave of absence to handle special assignments for **Charles Allen Thomas,** pres.

Plastics Div.: A divisional development department has been formed at Springfield, Mass., with **David S. Plumb** as dir.; **Dr. Harry M. Walker,** formerly mgr. of research develop-

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Multi-Spindle Rotary Finisher

That Performs ALL These Operations On Circular Parts:

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No. 103 Flash Lathe

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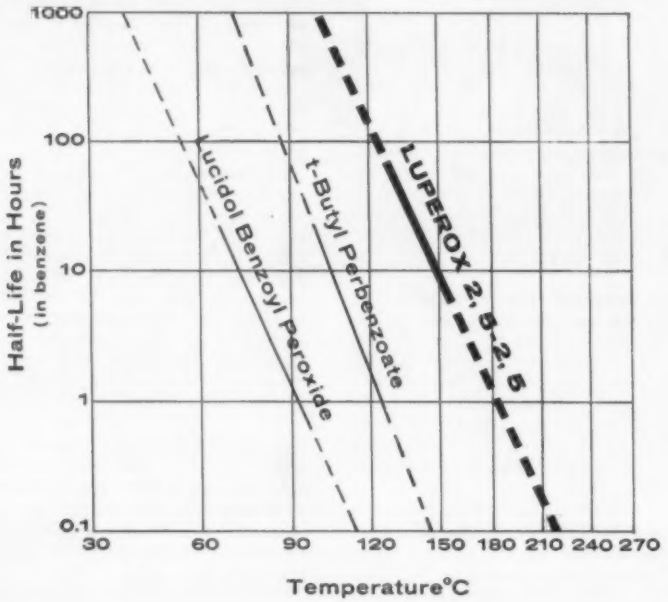
2,5-DIMETHYLHEXANE – 2,5-DIHYDROPEROXIDE



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WITH UNUSUALLY LONG HALF-LIFE

SPECIFICATIONS

2,5-Dimethylhexane-2,5-Dihydroperoxide	90.0% (min.)
Active Oxygen	16.1% (min.)
Form	White, crystalline

LUPEROX 2,5-2,5 was especially developed by the LUCIDOL DIVISION Research & Development Laboratory, to provide a non-volatile, high temperature polymerization catalyst. The presence of two hydroperoxide groups indicates the possibility of the formation of a diradical, which should make it a valuable polymerization initiator. The long half-life at high temperature as indicated by the above curve, emphasizes the wide potential range of application for this product. Exotherm measurements (S.P.I. procedure) at 212°F. and 266°F. in several typical unsaturated polyester resins indicate that LUPEROX 2,5-2,5 is about equivalent to t-butyl perbenzoate and more active than di-t-butyl peroxide in initiating polymerization reactions. LUPEROX 2,5-2,5 should also find application in the rubber and silicone industries where a stable, non-volatile, high temperature catalyst is desired.

WRITE FOR DATA SHEET

LUCIDOL DIVISION

WALLACE & TIERNAN INCORPORATED
Dept. 4, 1740 Military Road
Buffalo 5, New York

Companies ... People

ment at Texas City, Texas, named asst. dir. Other appointments in the department include **R. W. Crawford**, who will continue as consultant to general management, and **Miss Arek Omartion**, who will continue business research activities. **W. T. Dickens**, asst. to the dir. of plastics product sales; **S. P. Lio**, asst. sales mgr. in the Lustrex Sales Dept. **H. K. Eckert** appointed to newly created post of asst. gen. mgr., responsible for coordinating over-all administration at Texas City, Texas.

Du Pont—Polychemicals Dept.: Robert A. Kellar now marketing mgr. for Teflon resin; **Ray B. Campbell, Jr.** succeeds Mr. Kellar as asst. marketing mgr. and **John I. Hughes** replaces Mr. Campbell as mgr. of the marketing analysis section.

Society of Plastics Engineers, Inc.: The following officers were elected for 1958: pres.—**R. Kenneth Gosset, Gosset & Hill Co.**, Chicago, Ill.; VP—**Fred C. Sutro, Jr., Spencer Chemical Co.**, Kansas City, Mo.; secy.—**George Martin, Holyoke Plastics Corp.**, Holyoke, Mass.; and treas.—**G. Palmer Humphrey, R. C. Molding, Inc.**, New Hyde Park, N. Y.

Diamond Alkali Co., Plastics Div.: Jack E. Zimmerman, formerly group leader in development, now asst. mgr. of research and development; **Nathan M. Blackman** succeeds Mr. Zimmerman as group leader in charge of the laboratory's pilot-plant section. **Joseph V. Hartman, Jr.** promoted from tech. service rep. to group leader of the applications section of the plastics research and development laboratory.

The Market Research Section of the Commercial Development Dept., formerly concerned principally with new products, is being enlarged to provide increased research on existing products for the company's seven operating divisions and Sales Dept. **Kemble S. Lewis**, previously sales mgr. of the Plastics Div., appointed to head the newly formed sales market research group. **Harry H. Redlich** named div. market analyst.

National Cylinder Gas Co.: A new **Processing Equipment Div.** set up to supply automatic continuous processing equipment to the plastics and other industries. **John E. Slaughter, Jr.** appointed pres. of the division and **Lyman L. Dawson**, VP. Activities will include production of Votator heat exchange equipment and Thermex high-frequency dielectric heating equipment.

The company now has a total of seven divisions, of which **Tube Turns**

(*To page* 264)

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Versatile GLIDPOL and GEL-KOTE polyester resins are also used in motor vehicle bodies, luggage, guided missiles and hundreds of other products.

*A Glidden Trade-Mark

A request on your company letterhead will bring you a copy of Technical Bulletin MP-458 which fully describes all of the Glidden GLIDPOL resins for casting, laminating, molding and coating.

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Plasticizers at lowest cost if you are a careful buyer

You can save money if you buy your plasticizers carefully—take advantage of one-stop service from Monsanto. Here's why:

- mixed shipments *in bulk* give you the lowest price per pound*
- plant time is saved by handling just one shipment instead of two or more at different times
- inventory is never larger than necessary because *mixed* bulk shipments give you *smaller* quantities of two or more plasticizers (at the *larger* bulk discounts)—save warehouse space
- working capital is reduced with lowest costs—smaller inventories to warehouse and pay for
- paper work is simpler when *one* purchase order brings every plasticizer—cuts bookkeeping time and cost of multiple orders to a number of suppliers.

For important savings, ask Monsanto to help you develop your plan for low-cost, one-stop purchasing.

*HOW ONE-STOP BUYING FROM MONSANTO GIVES LOWEST COST

Three suppliers — three shipments versus one mixed truckload from Monsanto

DOP—5,000 lbs. @ 31.5¢/lb. (LCL) from Supplier A	$1575	@ 30.5¢/lb. (T/L) from Monsanto	$1525
TCP—5,000 lbs. @ 36¢/lb. (LCL) from Supplier B	$1800	@ 35¢/lb. (T/L) from Monsanto	$1750
Santicizer 160—10,000 lbs. @ 30¢/lb. (LTL) from Monsanto	$3000	@ 29¢/lb. (T/L) from Monsanto	$2900
Totals	$6375	versus	$6175

You save $200 on 20,000 lbs.

Two suppliers — two shipments versus one mixed tank-truck from Monsanto

DOP—10,000 lbs. @ 30.5¢/lb. (T/L) from Supplier A	$3050	@ 28¢/lb. (T/C) from Monsanto	$2800
TCP—10,000 lbs. @ 35¢/lb. (T/L) from Supplier A	$3500	@ 32.5¢/lb. (T/C) from Monsanto	$3250
Santicizer 160—10,000 lbs. @ 29¢/lb. (LTL) from Monsanto	$2900	@ 26.5¢/lb. (T/C) from Monsanto	$2650
Totals	$9450	versus	$8700

You save $750 on 30,000 lbs.

Costs based on price schedules—December 3, 1957

21 Plasticizer Service Centers for your convenience

SEE HOW NEAR YOU ARE TO SUPER-FAST DELIVERY FROM MONSANTO. Fast one-stop service from a convenient source helps you reduce inventories without fear of running short—conserves your working capital. Monsanto ships plasticizers fast from 21 Service Centers—6 bulk storage stations, 13 strategically located warehouses and 2 modern plants. Chances are, one of them is only hours away from you. Check the mileage from your area to the nearest Monsanto *bulk station*. For super-fast dependable delivery, ask Monsanto to help you arrive at the best, most advantageous way of shipping and handling for your conditions.

MILEAGE FROM BULK STATIONS

YOUR AREA	Everett, Mass.	St. Louis, Mo.	Akron, Ohio	Greensboro, N. C.	Perth Amboy, N. J.	Long Beach, Calif.
Atlanta, Ga.	990	550		320		
Baltimore, Md.	410	816			180	
Boston, Mass.	10	1189				
Buffalo, N. Y.	409	732	215		340	
Charlotte, N. C.	800	635		90		
Chicago, Ill.	858	295	350			
Cincinnati, Ohio	768	346	235			
Cleveland, Ohio	476	541	34			
Columbus, Ohio	665	415	123			
Detroit, Mich.	640	515	178			
Greensboro, N. C.	630	640		0		
Indianapolis, Ind.	832	240	295			
Kansas City, Mo.	1270	255				
Los Angeles, Calif.	3099	1901				22
Louisville, Ky.	758	264	346			
Memphis, Tenn.	1152	306				
Milwaukee, Wisc.	1024	375	445			
Minneapolis, Minn.	1280	567	776			
Newark, N. J.	156	858			20	
New York, N. Y.	250	965			20	
Philadelphia, Penn.	320	888			64	
Pittsburgh, Penn.	474	600	108			
Providence, R. I.	45	1024			192	
Toledo, Ohio	640	468	123			
San Francisco, Calif.	3213	2140				384
St. Louis, Mo.	1024	0				
Wilmington, Del.	320	793			88	

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BULK STATION PLASTICIZERS

St. Louis, Missouri
Dibutyl Phthalate
Diethyl Phthalate
Dimethyl Phthalate
Dioctyl Phthalate (DOP)
Diisooctyl (DIOP)
Diisodecyl Phthalate—Electrical (DIDP-E)
Santicizer 160
Tricresyl Phosphate
Santicizer 140
Santicizer 141
Santicizer E-15

Everett, Mass.
Dibutyl Phthalate
Dioctyl Phthalate (DOP)
Diisooctyl (DIOP)
Diisodecyl (DIDP)
Diisodecyl Phthalate—Electrical (DIDP-E)
Santicizer 160
Dioctyl Adipate (DOA)
Diisodecyl Adipate (DIDA)
Tricresyl Phosphate
Santicizer 141

Akron, Ohio
Dibutyl Phthalate
Dioctyl Phthalate (DOP)
Diisodecyl Phthalate (DIDP)
Santicizer 160
HB-40

Perth Amboy, N. J.
Dibutyl Phthalate
Diethyl Phthalate
Dimethyl Phthalate
Dioctyl Phthalate (DOP)
Santicizer 160
Tricresyl Phosphate
Santicizer 140
Santicizer 141
HB-40

Long Beach, California
Dibutyl Phthalate
Dioctyl Phthalate (DOP)
Diisodecyl Phthalate (DIDP)
Santicizer 160
Tricresyl Phosphate

Greensboro, N. C.
Dioctyl Phthalate (DOP)
Diisodecyl Adipate (DIDA)
Santicizer 160
Tricresyl Phosphate
Santicizer 141

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Companies... People

Plastics, Inc., producer of plastic pipe fittings is one.

Chemical Products Div.: Dr. John N. Pattison named dir. of research and development for Girdler catalysts. John W. Benedict appointed sales mgr.

Improved Machinery, Inc., Nashua, N. H.: **Kent W. Smith**, treas. and dir. since 1949, elected VP. **Herbert G. Vore** promoted from development engineer to tech. dir. **Frank Z. Bailey**, formerly a sales rep., now sales mgr. —plastics machinery.

Reichhold Chemicals, Inc.: Four div. mgrs. for chemical sales appointed: **W. D. Conrad** will manage the Central Atlantic Div. from the Charlotte, N. C., plant; **W. A. Gerhardt**, the Pacific Southern Div. from the Azusa, Calif., plant; **G. D. Lamont**, the Midwest Div., from the Detroit, Mich., plant; and **R. J. Read** as northeastern mgr. of chemical sales will headquarter at the Ballardvale, Mass., plant.

Logo, Inc., 12933 S. Stony Island Ave., Chicago 33, Ill., which operated as a wholly owned subsidiary, has been dissolved and merged with the parent organization, **Bee Chemical Co.** It will now function as **Logo, Inc. Div.**, with ownership and management remaining the same.

U. S. Industrial Chemicals Co., Div. of National Distillers & Chemical Corp.: William H. Radar appointed asst. prod. mgr. for Petrothene polyethylene resins.

The company's Boston office has been relocated to 150 Causeway St. No changes made in the warehouse facilities.

F. J. Stokes Corp.—Vacuum Equipment Div.: Sales office opened at 77 Bedford St., Stamford, Conn., to serve New England, the Bronx, and Long Island. The Mount Vernon, N. Y., office was closed and **John C. Coleman** was transferred to manage the new office.

F. J. Stokes Co. of Canada, Ltd. has moved its Toronto, Ont., headquarters to 4198 Dundas St. W., with **Fred Y. Walters** as mgr. of the subsidiary.

The Dow Chemical Co. has opened a sales office in the Dallas Federal Bldg., 1505 Elm St., Dallas, Texas. **Donald P. Camp**, formerly head of chemical sales at the Houston office, named mgr.

General Electric Co.—Chemical and Metallurgical Div.: Albert M. Hunt named a chemist in the New Product Development Laboratory to work in the analytical section on Lexan poly-

Rigid plastic sheeting for every purpose

Stock sizes up to 51" x 108"

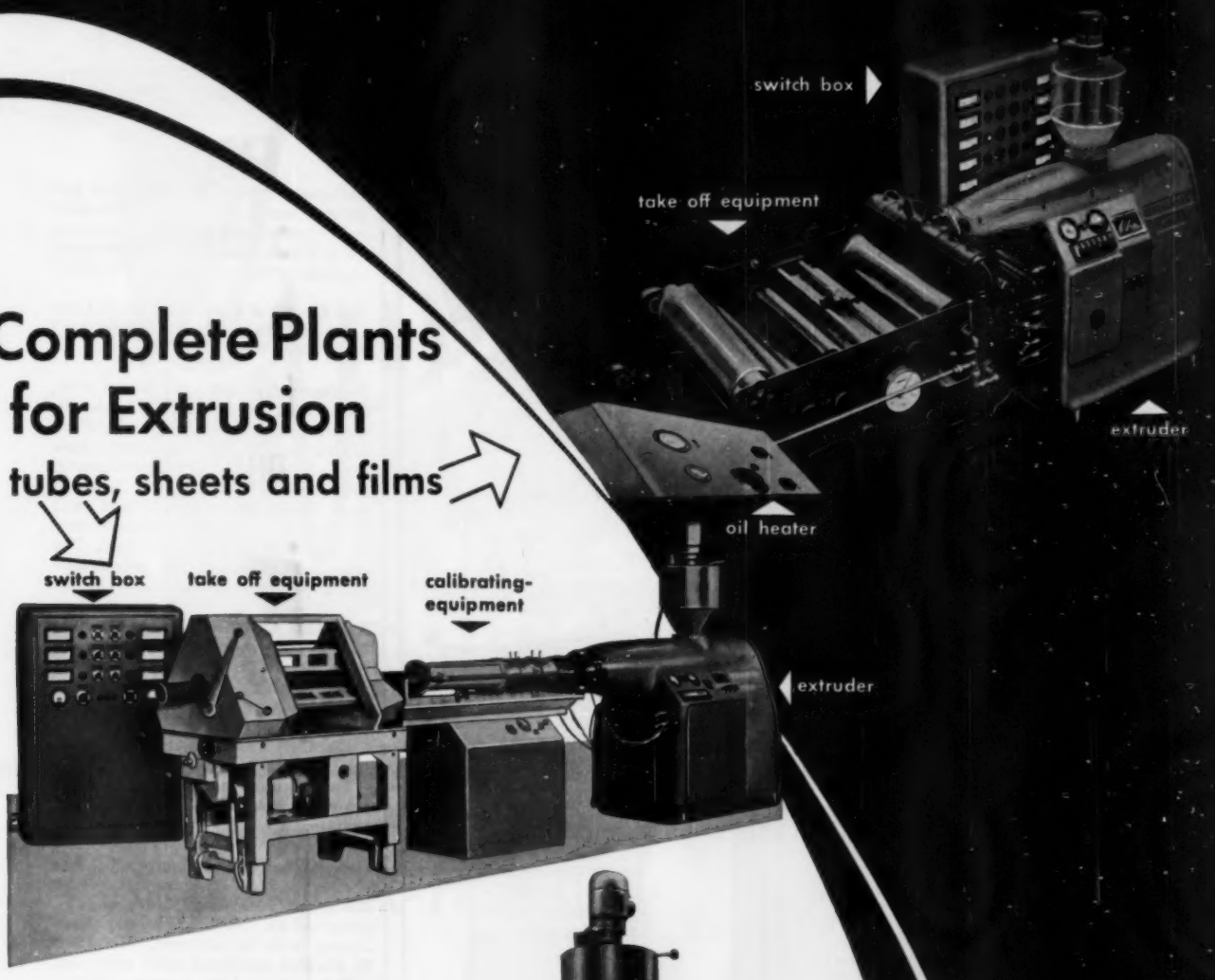
Available transparent, translucent, or opaque — in a wide range of colors.

Scranton Plastic Laminating Corp.

3218 PITTSTON AVE., SCRANTON 9, PA.

Complete Plants for Extrusion

tubes, sheets and films



Extruder S 90 RGV
90 mm screw-diameter = 3.54 "

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Companies ... People

carbonate. **Leroy A. Claybaker** appointed supv. of mfg. at G-E's phenolic varnish operation at Coshocton, Ohio, which is a satellite of the main phenolic products plant at Pittsfield.

Sun Chemical Corp. has moved from Long Island City, N. Y., to 750 Third Ave., New York 17, N. Y.

Productol Co., 10051 Romandel Ave., Sante Fe Springs, Calif.: **Charles H. Braithwaite,** formerly with Food Machinery & Chemical Corp., now dir. of research and development. **William Martin** joined the Research and Development Dept. and will specialize in product development in the resin and plastics field. The company manufactures petroleum-based phenol, cresols, and xylenols.

Eastman Chemical Products, Inc., Tenite Plastics Div.: C. B. Fox, Jr., formerly in the Chicago office, appointed sales rep. in charge of the Plastics Div. office in St. Louis, Mo. **Paul J. Wright,** previously sales correspondent at Kingsport, Tenn., named Chicago sales rep.

The Toronto sales office has been relocated from 224 Merton St. to 164 Eglinton Ave., E., Toronto, Ont.

Federal Tool Corp., Chicago, Ill., has opened its first direct sales office at 230 Fifth Ave., New York, N. Y., from which New York and New Jersey will be covered. **Woodrow H. Pereira** appointed sales mgr. and will be assisted by **Howard Bruno.**

Plastic Age Co. and its affiliates, **Plastic Age Sales, Inc., Plastic Age Aircraft Corp.,** and **Plastic Age Reinforced Products Co.,** have moved from San Fernando, Calif., to enlarged quarters at 14300 Davenport Rd., Saugus, Calif.

Fabri-Kal Corp., Kalamazoo, Mich.: **Robert G. Pierce,** formerly with Celotex Corp., appointed sales mgr. The company manufactures formed sheet plastics parts and packaging.

Pittsburgh Coke & Chemical Co.: Wells E. Hudson, named project mgr. of the Commercial Development Dept., will evaluate and coordinate projects under study by the chemical group.

Industrial Chemicals Div.: Joseph H. Ward appointed New York sales rep.

National Automatic Tool Co., Inc., Plastics Machinery Div., Richmond, Ind., appointed the following distributors: **Moehlenpah Engineering, Inc.,** 1315 S. Vandeventer Ave., St. Louis, Mo.; **Stanley Berg Machinery Co.,** 1231 Banksville Rd., Pittsburgh, Pa.; **Harron, Rickard & McCone of**

...these machines give

BATTENFELD
constructs machines
for every kind of
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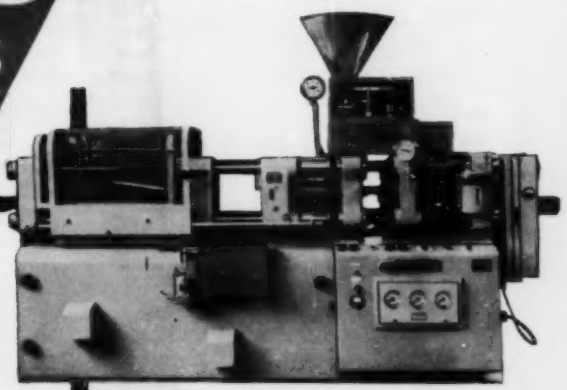
MOST ECONOMICAL PRODUCTION



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Extruders and Complete Automatic Plants

Fully Automatic Serial Extruders for closing device

Automatic Bottle Blowing Machines

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are known all over the world. Their extraordinary mechanical advantages lie in their fully automatic operation, in the simple electro-mechanical design and their reliability maintained during continuous service.

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REINFORCING BLANKETS

to BUILDING BOARD!

You'll get profitable new products boasting these big sales features:

EXCELLENT WEATHERABILITY—Troytuf Orlon reinforcing "toughens up" building board, enables it to withstand the worst weather, year-in year-out, year after year. *(See pictures below).*

WIDE VERSATILITY—Troytuf Orlon can be laminated to any building board, used for almost any building.

GREAT ECONOMY—Troytuf Orlon serves as permanent "coat of paint," makes use of low-cost building materials feasible, economical.

"TROUBLE-FREE" LEGALITY—Since Troytuf Orlon acts as a "coat of paint," it conforms to local building codes, presents no legal problems.

FUNCTIONAL BEAUTY—Troytuf Orlon has a pleasing fabric texture. Combinable with paint in all shades of the rainbow, it offers enticing new opportunities in exterior design.

WHAT IS TROYTUF ORLON? Troytuf Orlon blanket is an extra-tough, lightweight reinforcing material, specially suited to laminating. It differs from most reinforcing media in that its fibres are tightly interlocked into easily-handled blanket form by a novel needle-punching operation.

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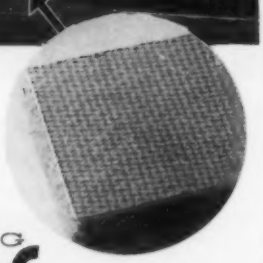
NOW IN USE: Troytuf Orlon-reinforced IPM panels serve as effective weather-shields on Bremerton Elementary School, Bremerton, Wash. The school is one of eight public buildings in the area to use this panel, made by Industrial Plastics Manufacturing Co., Seattle, Wash.



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Your Needs—and Imagination—Set the Only Real Limits to Troytuf's Uses

Companies . . . People

Northern California, 2070 Bryant St., San Francisco, Calif.; **Ellison Machinery Co.,** 160 W. 33rd St., Los Angeles, Calif.; and **W. E. Shipley Machinery Co.,** 1421 Chestnut St., Philadelphia, Pa.

Davis-Standard, Div. of Franklin Research Corp., Mystic, Conn.: **Philip Greene,** formerly salesman for New York, New Jersey, and southwestern Connecticut, promoted to sales mgr. The wire and cable accounts in this area will now be handled by **John McCormick.**

E. V. Larsen Co., Ltd., Toronto, Ont., named Canadian sales rep. and **Norton C. Wheeler, Jr.** will concentrate solely within New England and upper New York state.

Haskelite Mfg. Corp., Grand Rapids, Mich.: **Robert Sanford, Lester Barrow,** and **Patrick Law** appointed dist. sales mgrs. in Chicago, Ill.; Albany, N. Y.; and Atlanta, Ga., respectively.

Continental-Diamond Fibre Corp., a subsidiary of **The Budd Co.: E. Wayne Frazer** appointed export sales mgr. **Allen Ballard** named New York dist. sales mgr. and **Harold Moyer** Philadelphia dist. sales mgr.

Ludlow Papers, Inc., Needham Heights, Mass.: **Plastics Div.** formed to centralize extrusion of plastics materials. **Malcolm J. Odell,** previously dir. of research, appointed gen. mgr. of the division. He is succeeded by **Robert S. Ives,** formerly head of Ives Laboratories, Cambridge, Mass.

Production and purchasing are concentrated at the company's Homer, La., plant under **James Lowe,** mgr.

Stein Hall & Co., Inc. has opened a sales office in the Wilson Bldg., Dallas, Texas, with **Ronald Goodnight** as mgr. The company manufactures polyvinyl acetate, emulsions, vinyl resins, hot melt adhesives, etc.

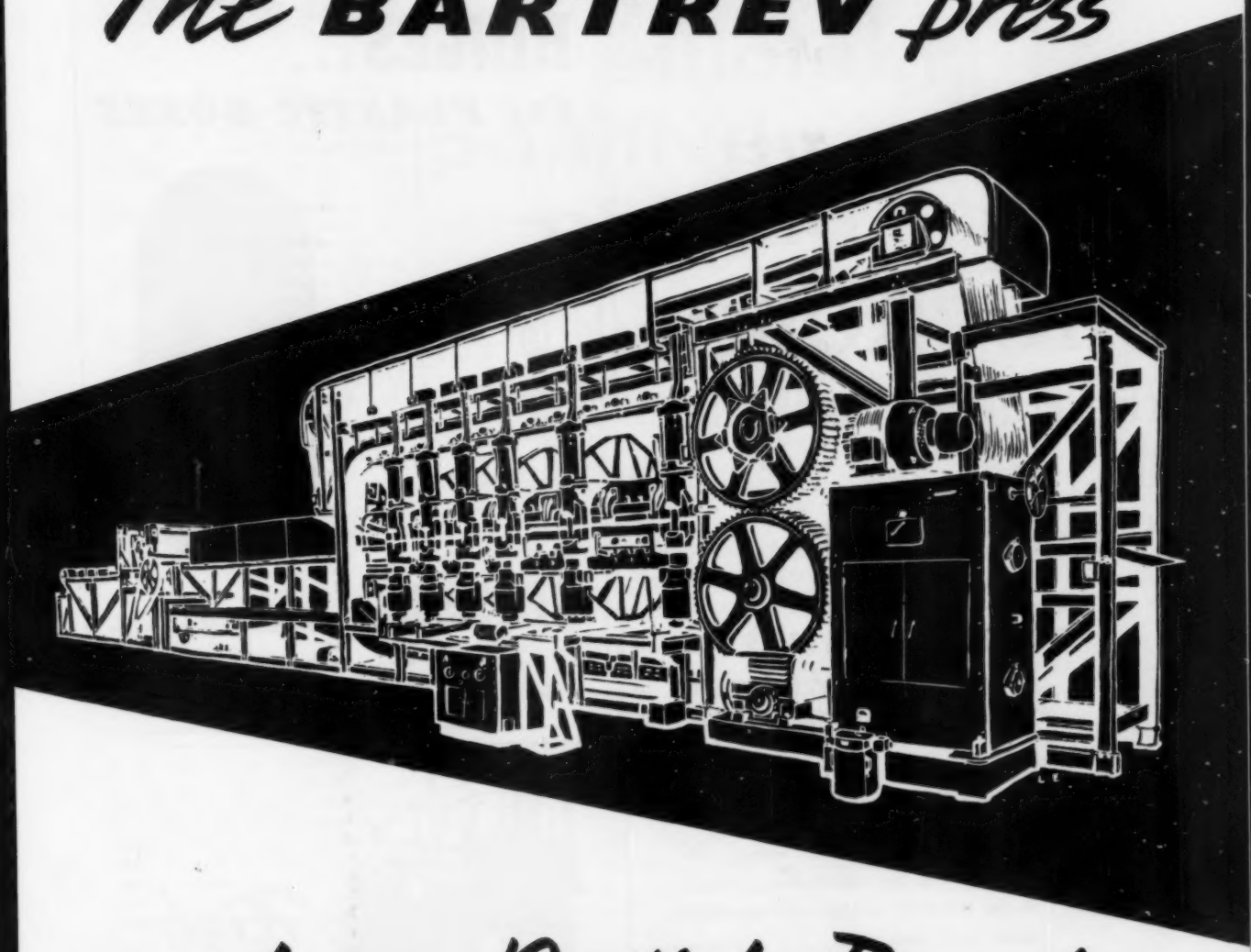
The Pantasote Co., Passaic, N. J., has established a West Coast warehouse and sales organization at 2627 San Fernando Rd., Los Angeles, Calif., with **Jules Pilcher** as mgr.

Precision Metal Products of Malden, 41 Elm St., Stoneham, Mass., named a distributor of laminated plastic sheets by **Synthane Corp.,** Oaks, Pa.

Testing Machines, Inc., producer of testing instruments for plastics materials, paper, rubber, etc., has moved from 123 W. 64th St., New York, N. Y., to 72 Jericho Turnpike, Mineola, N. Y.

The company has opened a new department for custom designing of

The BARTREV press



produces Particle Board in any length

BARTREV Plants incorporating the largest continuous press in the world, manufacture particle board in any length. The process is highly flexible in that rapid adjustments can be made to effect changes in the board thickness ($\frac{1}{4}$" to $\frac{3}{4}$") or density (0.50 to 0.80 gms/cc), the resin content and the production of single or three-layer board. Once these variables are set, production and quality are controlled automatically, reducing labour costs and ensuring uniformity of the product. A Bartrev Press is capable of producing 90 tons of board per day or over 17,000,000 square feet per annum, with a labour force, reduced by automation, to only 16 men per shift.

Complete technical information and "know-how" for the operation of the Plant are provided. Engineering of the complete Plant, including the provision of all necessary drawings, recommendations for the installation of the Press and advice on factory layout will be undertaken if required. Bartrev Plant operators will be given the benefit of technical developments and research carried out by International Plastics Limited and its associated Companies.

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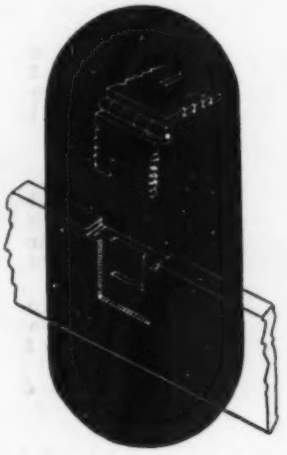

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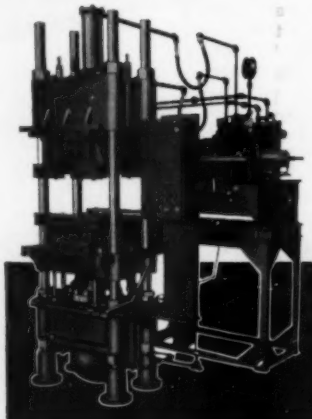

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new instruments and for modifications of existing instruments. A department for the purchase and sale of used and reconditioned equipment has also been established.

Cadillac Plastic & Chemical Co., 15111 2nd St., Detroit 3, Mich., appointed distributor of polyvinyl alcohol film manufactured by **Mono-Sol Corp.**, Gary, Ind.

Line Materials Industries, McGraw-Edison Co., Milwaukee, Wis., named national distributor of plastic pipe and fittings produced by Anesite Co., 3575 W. Touhy Ave., Chicago, Ill.

Mosher & Peyser, 925 Great Plain Ave., Needham, Mass., mfr's rep., appointed to handle sales for fabricated plastics and metal parts in New England for **Universal Unlimited, Inc.**, Glen Cove, N. Y.

Addy & Goetz Machinery Co., 1825 Superior Bldg., Cleveland 14, Ohio, named a distributor by **Hamilton Div., Baldwin-Lima-Hamilton Corp.**, Hamilton, Ohio.

Harry T. Marks, exec. VP, elected pres. of **Ferro Corp.**, Cleveland, Ohio, to succeed the late **C. D. Clawson.**

Prof. Giulio Natta, of the **Polytechnic Institute**, Milan, Italy, was unanimously elected a fellow of the New York Academy of Sciences "in recognition of his latest revolutionary discoveries in the field of polymer chemistry—stereospecific polymerization of olefins and diolefins"—which led to the introduction of isotactic polypropylenes.

Thomas G. Gibian now gen. mgr. of the **Organic Chemicals Div.** of **Dewey and Almy Chemical Co., Div. of W. R. Grace & Co.**, Cambridge, Mass., succeeding **Russell L. Haden** who joined **Virginia-Carolina Chemical Corp.** Mr. Gibian will also continue as gen. mgr. of the firm's **Battery Separator Div.**

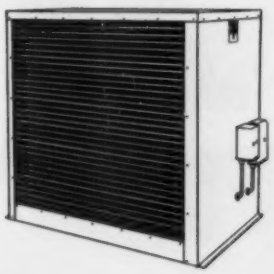
Charles H. Rybolt named dir., Chemical Divs. of **Wallace & Tiernan, Inc.**, Belleville, N. J. He will also retain his present position as gen. mgr. of the **Lucidol Div.**, Buffalo, N. Y.

H. Curtis Colby, Jr., previously with Naugatuck Chemical, Div. of U. S. Rubber Co., now mgr. of market development of specialty products for the **Polymer Products Div.** of **Foster Grant Co., Inc.**, Leominster, Mass.

Roy H. Hoonhout, formerly with Mack Molding Co., appointed VP of **Monroe-Danford & Co.**, 50 48th St., Weehawken, N. J. The company represents several manufacturers sup-

efficient, positive chilling

of plastic molding machines without water

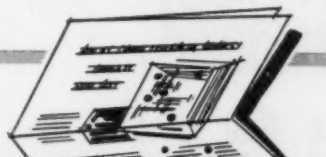


VIC air cooled LIQUID CHILLERS for injection molding . . . calenders . . . embossing . . . extrusion takeoff rolls or baths . . . and laminating.

Eliminate water and sewage costs. VIC unit is completely air cooled . . . chills and re-circulates same water continuously. No hookup to water system necessary.

You can rely on positive temperature control *within 3 degrees* with any VIC liquid chiller. Made in five sizes from 2 to 10 h.p., to handle most jobs; can be adapted or custom built to meet special requirements.

Each VIC unit is self-contained, completely packaged, ready for quick, easy installation, easy servicing . . . for use with a single machine or as a central system for many units. Unit takes only 15 sq. ft. of floor space. Can be adapted for outside installation.



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Send your name and company address now for full information and data sheet to help you select size of unit necessary for your operation. Distributor inquiries invited.

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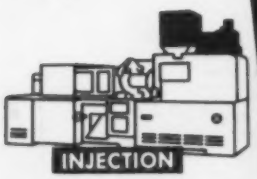

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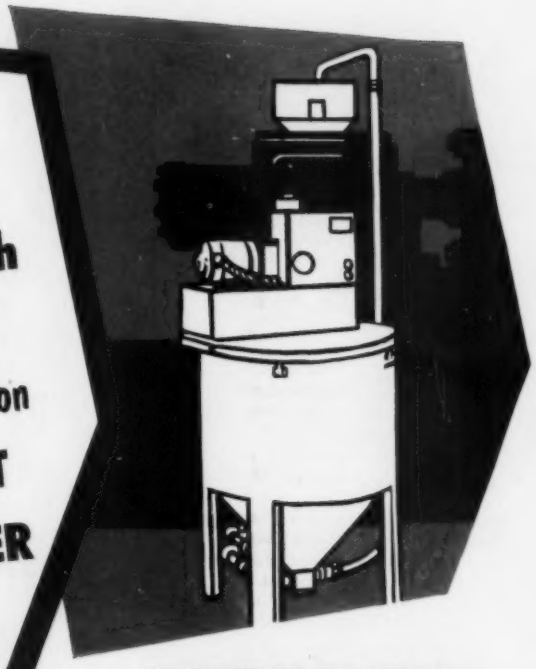

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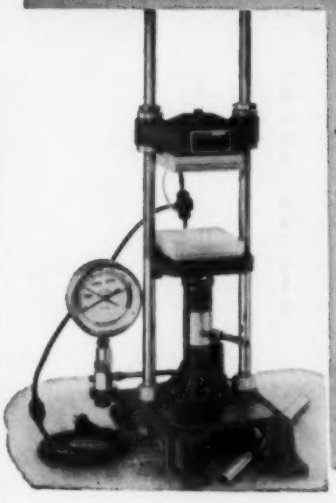

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plying custom molded plastic items, packaging items, aerosol components, etc., and provides a number of services for the industries.

Milton A. Sanders appointed VP, sales, of **Connecticut Plastics Products Co., Inc.**, Waterbury, Conn., to succeed **Howard F. Reichenbach,** resigned.

Joseph Foier promoted to VP and sales mgr. of **American Molding Powder & Chemical Corp.**, 703 Bedford Ave., Brooklyn 6, N. Y. He formerly held supervisory posts in the Sales and Production Depts.

Gilbert G. Southwick, formerly pres. of Childhood Interest and a former pres. of the Toy Manufacturers Association, appointed gen. mgr. of the new infant and pre-school division of **Ideal Toy Corp.**, 200 Fifth Ave., New York 10, N. Y.

Bernard H. Jacobson, VP and dir. of **Food Machinery & Chemical Corp.**, was presented the 1958 Honor Award of the Commercial Chemical Development Association in recognition of his pioneering work in the development of plasticizers for vinyl resins and related products.

Stanley F. Brenegan, formerly sales supv. of the Calendered Materials Div., now mgr. of the Consumer Products Dept. of **Canadian Resins & Chemicals, Ltd.**, Montreal, Que.

J. R. Hammond, named assistant to the pres. of **Molded Fiber Glass Body Co.**, Ashtabula, Ohio, will also work with its subsidiary, **Molded Fiber Glass Boat Co.**, Union City, Pa.

Donald A. Drake named Southwestern dist. mgr. for **Tube Turns Plastics, Inc.**, Louisville, Ky., producer of PVC pipe. The new district sales office is located at 7714 Wedgewood Lane, Houston, Texas.

William B. Philipbar, Jr. appointed product sales mgr. of the **Stearates Div., Nuodex Products Co.**, a **Div. of Heyden Newport Chemical Corp.**, 342 Madison Ave., New York 17, N. Y.

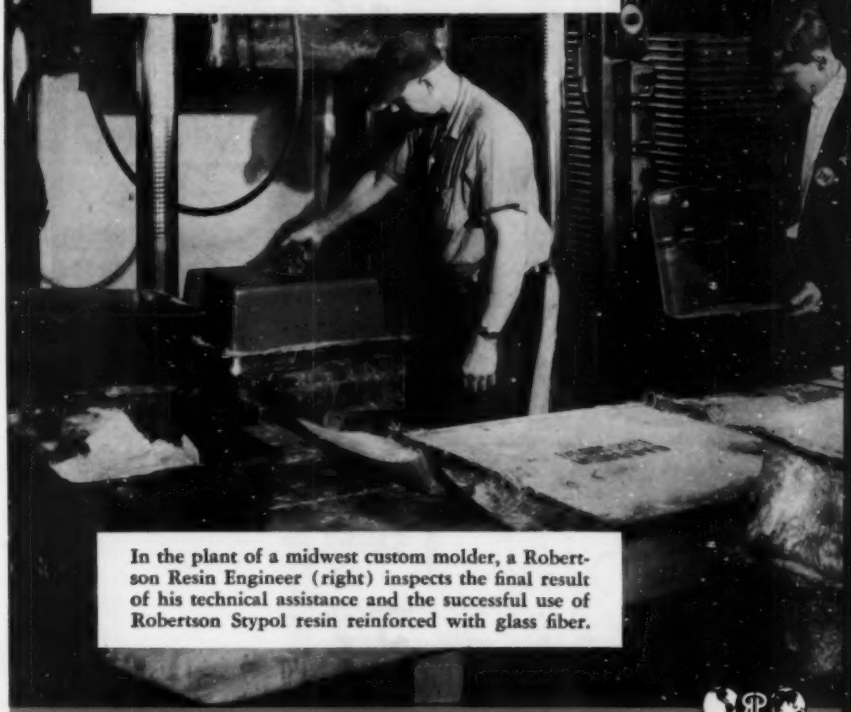
Gerald Kerstein appointed sales mgr. of the **Compound** and **Color Concentrate Divs.** of **The Blane Corp.**, Canton, Mass., manufacturer of vinyl compounds and vinyl color concentrates.

Donald Culver, named sales mgr. of **Industrial Plastic Fittings Co.**, 3891 W. 150th St., Cleveland 11, Ohio, will cover the application of the firm's nylon and styrene copolymer insert fittings with flexible and rigid poly-

Stypol's superior

Hot Strength

solves a tough mold problem



In the plant of a midwest custom molder, a Robertson Resin Engineer (right) inspects the final result of his technical assistance and the successful use of Robertson Stypol resin reinforced with glass fiber.

Robertson Stypols (polyesters) offer outstanding craze and blow resistance on short high temperature cure cycles plus far better than average hot strength and mold release properties, particularly in complex large moldings. One of the Stypols resists crazing in paint oven systems up to 260°F. In addition, these resins have an unusual ability to bury fibers so that the surface of molded parts is very smooth to the touch. Clip the coupon below and attach it to your letterhead if you would like a qualified Robertson engineer to work in your shop with you on your specific problem.

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Companies . . . People

ethylene pipe. He will also continue to serve **Murray Corp.**, Towson, Md., in marketing the company's flexible plastic pipe fittings.

W. Pat Fralia named sales mgr. of **Lone Star Plastics Co., Inc.**, 124 Roberts Cut-Off Rd., Fort Worth, Texas. The company produces plastics component parts for aircraft, oil field equipment, and electronics manufacturers.

Armin H. Holzach joined the Sales Dept. of the **Thermoplastic Div.** of **Catalin Corp. of America** and will cover New York City.

Jerry Slavin named sales mgr. of **H. B. Fuller Co.**, St. Paul, Minn., manufacturer of industrial adhesives.

Russell E. Schoeller, formerly tool buyer for Chicago Molded Products, appointed direct factory rep. for **Electromold Corp.**, Trenton, N. J.

John R. Lawrence, named polyester coordinator for **The Glidden Co.**, Cleveland, Ohio, will be responsible for the development and sale of polyester products, including resins, coatings, and foam.

Jack H. Kubanoff has joined **Fluorocarbon Products, Inc.**, a **Div. of U. S. Gasket Co.**, Camden, N. J. He will be responsible for the design, development, and engineering of new products.

Rolla H. Taylor appointed asst. sales mgr. of **Scott Testers, Inc.**, Providence, R. I.

Robert B. King appointed sales engineer in the Chicago dist. office of **Arthur Colton Co.**, Detroit, Mich., manufacturer of production equipment for plastics.

Edward W. Ribolin now Midwest sales rep. for the **Impregnating Div. of Fabricon Products**, with headquarters at River Rouge, Mich.

J. Harold Campbell appointed chief engineer of **Whitso, Inc.**, Schiller Park, Ill. He will also assume particular responsibility for new product development. The firm manufactures molded plastic products and blow-loading automation machinery.

Correction

"New anti-static compounds," p. 224, March 1958: Second sentence in second paragraph should read "Applied to a surface capable of accepting a static charge, the compound forms a *tough* non-tacky film, completely transparent and of high dielectric strength."

Swedlow specializes in heat protection!

Silicones
Phenolics
Epoxies
Reflective coatings
Sheet materials
Molded parts

The solution to your heat problem is in the following...

Swedlow's aluminum-metallized heat reflective laminates 1650°F

MINIMUM WEIGHT • MINIMUM BULK—By combining the principles of highly efficient reflectivity of aluminum-metallized surfaces with the low thermal conductivity of glass fabric reinforced plastic laminates, Swedlow's "—101" metallized coatings offer protection up to 1650° F. The metallic coating protects the base laminate from thermal degradation.

APPLICATIONS—In flat sheets, or molded into complex contours, these materials are suggested as highly efficient heat blankets for compartment insulation, valve protection, exhaust heat damping, and other applications where there is prolonged high temperature exposure.

Swedlow's silicone plastic laminates 650°F

Swedlow's X5G-138 and X5G-176 silicone base materials are available as flat sheeting or molded parts and offer protection up to 650° F.

Swedlow's X5G-138 provides maximum strength per unit of thickness and weight and is recommended for applications requiring flat sheets or simple contoured molded parts.

The X5G-176 laminate has slightly lower physical properties than X5G-138 but is recommended for applications requiring complex contours.

APPLICATIONS—Missile nose cones, exit cones, fins, stabilizers, adapter rings, closure rings, and similar uses. Applications in airstreams at missile speeds are possible.

For short duration of time the temperatures given for the above materials may be raised appreciably. Each application must be considered individually.

Swedlow is continuing research in high-temperature materials of all types . . . reflective coatings, ceramics, plastics, metals.

A highly trained staff of engineers and technicians will be pleased to assist you on the use of these materials for high temperature service. Please contact the plant nearest you.

600°F *Swedlow's high temperature phenolic plastic laminates*

STABLE PHYSICAL PROPERTIES UNDER HIGH TEMPERATURES—Swedlow's X4G-116 is a high-temperature phenolic laminate that offers unusual physical stability at high temperatures up to 600° F. It is available in flat sheets, and can be molded to complex contours.

APPLICATIONS—Fins, stabilizers, missile nose cones, adapter rings, closure rings, and similar applications. May be used in airstreams at missile speeds.

450°F *Swedlow's epoxy-plastic laminate*

Swedlow's X6G-141 epoxy-plastic laminate gives the user an electrical insulating material resistant to fracture and warpage in installation, with characteristics of very low moisture absorption and high physical strengths over a prolonged temperature gradient. Approved under MIL-P-18177. Conforms to NEMA standards for type G-3 materials.

APPLICATIONS—Air conditioning and heat distribution ducts. Winding barriers and ducting in transformers. Sheeting for circuitry installations. Dielectric capacitors for condensers. Terminal board and strip applications in electronic equipment. Coil spacers and relay bases in magnetic devices. Mounting plates, contact spacers and shielding for control devices.

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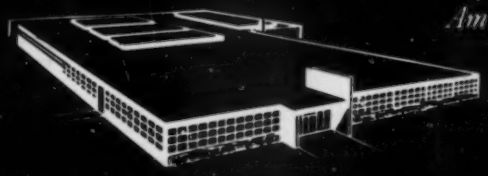

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INJECTION MOLDING MACHINES: For immediate sale: 10H-24 oz. Reed-Prentice 1948 model—Michigan location. 12 oz. Watson-Stillman 1950 model—Evansville, Indiana location, has weigh feeder. 16 oz. HPM 1944 model—Minneapolis location. Machines in good-operating condition. Reply Box 3423. Modern Plastics.

FOR SALE: Denison hydraulic presses, 15-ton capacity on each of twin rams, 32" diameter indexing table, 10HP pump motor. New 1942, used four years, good condition. Price $1250 with 30-day return privilege. Coastal Machinery Sales, 1780 Broadway, New York 19, New York.

FOR SALE: Injection Presses: Stokes Automatic 4 oz.—Jackson-Church 64 oz. HPM 24 to 4 oz. sizes.—Reed: 24, 16, 12 & 8 oz.—Lester 8 & 12 oz.—Watson: 48, 28 oz.—DeMattia 4 oz. vertical.—Lewis 6 & 4 oz. Van Dorn 1 oz.—For Extruders: 30" Sheet Die w. 52" pull-off.—36" Brown Vac. form & plug-assist setup.—Dulmage 28" Meterpump.—Despatch PLHD 2-5 lo draw. Oven.—Cumberland mod. 0 & 10 grinders.—Mold-Chiller circul.—2 HP boilers.—Apex 2 col. container imprint. mach. Markem 25A Printer.—Compression presses various sizes.—Elmes Hydrolair press 30 T.—Preformpresses Stokes 280 G and defiance 45.—Baker-Perkins 200 gal. mixers.—42 cft. Ribbonmixer. Vac. form mach. 30 x 30".—Dake 200 T. press.—List your surplus equipment with me.—WANTED: Extruders 1½" to 6" sizes. Defiance 20 preformpress.—All Midwest locations. Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: Power Roll-Leaf stamping press—Kensol model #110. Two air-operated main cylinders—hot chase plate—special air clamp. Will handle from flat items up to 24". Roll-Leaf printing on wide variety of items. Unit now set up and can be demonstrated. Reply Box 3415, Modern Plastics.

INJECTION MOLDING MACHINES: We offer the following machines for sale, which we have taken in trade, as we are distributors for new NATCO Injection Molding Machines: One 32-oz. HPM machine, new in 1950. Can be seen in good operating condition. One 16-oz. W-S Co., approximately 10 years old, has been reconditioned, and offer in good operating condition, complete with IMS cylinder and spare cylinder. One 12-oz. W-S Co., approximately 4 years old, complete with hopper dryer, thermolator, etc. May be seen in good operating condition. Can deliver immediately and have priced accordingly. Stanley Berg Machinery Co., 1231 Banksville Road, Pittsburgh 16, Pa.

FOR SALE: 3 Stokes preform presses, R, T and RD-4; 2 Stokes standard 200, 000 ton self-contained compression molding presses; 3 Cumberland O, ½ granulators, 3 HP; 1 Defiance #20 preform press; 1 Mitts & Merrill 10-N-9 pelletizer; also mixers, mills, grinders, etc. Chemical & Process Machinery Corp., 52 9th St., Brooklyn 15, N. Y., Phone: HY 9-7200.

FOR SALE: 6—Pfaudler 500 gal. glass-lined reactors. 7—stainless reactors: 50, 100, 150, 200, 450, 465 gal. 1500 HP Farrel horiz. reducer. Sigma blade mixers—2¼, 5, 10, 20, 30, 60, 75, 100, 150 gal., stainless and steel. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: 2 Denison presses, 25 and 15 ton; 1 Baker Perkins 15USE, 100 gal. all stainless double arm Vacuum mixer; 1—Baker Perkins size 15VUUM, 100 gal. double arm mixer, 100 HP motor; 1—Baker Perkins size JNM 100 gal. double arm mixer; 6—Day 250 and 100 gal. double arm mixers; 1—Ball & Jewell #1 Rotary Cutter; 2—Two Roll Mills 6" x 12"; 6—Stokes model DD2, DS3, D3 and B2 Rotary Preform presses; 4—Stokes model "R" single punch Preform presses; Also: Sifters, Banbury mixers, Powder mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: Lester-Phoenix Injection molding machine, model #L-3-12, serial #619. Purchased 1952. Machine in good condition, and may be seen in operation. Make offer. Reply Box 3413, Modern Plastics.

BALL & JEWELL GRINDER: No. 1-½. in good operating condition. 30-HP Motor, 220-3-Phase, ball bearing, stand, magnetic switches, extra knives sets, screens, etc. No reasonable offer refused. Machine can be inspected in daily operation at our plant. Reply Box 3420, Modern Plastics.

FOR SALE: 64 Oz. Injection Molder with Pre-Plasticizer mold size 32"x50" 750 Ton clamp. Lester 8 oz. Model 2 ½L (1949). DeMattia 12 oz. (1946). DeMattia 4 oz. H.P.M. Rubber Injection molders, 21½" x28" mold space, steam heated platens. Watson-Stillman 300 Ton Semi-Automatic Compression molding Press (1947) self-contained, mold size 34"x27". Watson-Stillman 250 Ton 28"x24". Watson-Stillman 140 Ton 22"x16". Waterbury Farrel 85 Ton 20"x24". W.F. 63 Ton 15"x15". Laboratory Presses—15 Ton 10"x8" and 10 Ton 6"x6" Platens. Scrap Cutters. Valves, Accumulators, Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

FOR SALE: Presses—1000 ton Vertical—300-400 ton 36"x36" platens—4 oz. Injection Machine—No. 1 Ball & Jewell Grinder—Carver Laboratory Presses—other Laboratory Presses to 75 ton—6"x13" Laboratory Mills—¾" Solenoid and Cam Operated Valves—Jacketed Heating Kettles. Plastic Machinery Exchange, 426 Essex Ave., Boonton, N.J. Telephone DE 4-1615—cable address Plasmex-Boonton.

FOR SALE: Injection Molding Presses: 2—10D 8 oz Reed's with IMS head; 1—10E 16 oz Reed with 22 oz head; 3—20-28 oz HPM's with Vicker pumps; Alladin Plastics, 5771 W. 96th St., L. A. 45, Calif.

FOR SALE: (6) 100 ton, 10" ram, 10" stroke @ $1250; (7) 200 ton, 9" stroke, 14" ram, 36x36, @ $2160; (6) 200 ton, 9" stroke, 15" ram, 30x30 @ $1850; (1) ton complete, 18x18 @ $1850; (1) 200 ton 16" ram, 30x30 @ $2460; (2) 200 ton 16" ram, 42x42 @ $2850; (1) 200 ton, 15" ram, 42x42 @ $2600; (3) 250 ton (2) 12" ram, 30x60 rebuilt @ $3675. Hydraulic Sal-Press Co., Inc., 386-90 Warren Street, Bklyn, N.Y.

FOR SALE: National Research 48" Vacuum Metallizing Unit Complete. Tilton & Cook Co., 38 Spruce St., Leominster, Mass.

GOOD EQUIPMENT: At the right price. Falcon Ribbon Blenders in Steel or Stainless; NRM 2½" Extruder, Rotary Cutters by Ball & Jewell, Sprout-Waldron, Abbe; Baker Perkins heavy duty dbl. arm Mixers, 100, 200, 300 gal; French Oil Mill Hydr. Press 450 Ton; Blaw Knox S/S Resin Kettle 7'6"x7'6", Jktd. Agtd.; Sturtevant 300 cu. ft. Batch Mixer; Stokes and Colton Rotary and Single Pre-form Presses; Send for new First Facts, containing complete illustrated inventory; First Machinery Corp., 209 Tenth St., Bklyn 15, N.Y. Fred R. Firstenberg, Pres.

LIQUIDATION SALE: Molding Plant; (2)—375 Ton French Oil Compression Presses. (1)—300 Ton Erie Compression Press. (2)—170 Ton Transfer Presses. (2)—100 Ton Compression. (3)—75 Ton Transfer Presses. (1)—No. 5½ T Colton Preform Machine. (1)—3 DT Colton Tablet Machine. Compressors, Pre-Heaters and miscellaneous shop equipment. Reply Box 3418, Modern Plastics.

FOR SALE: Stokes 300 ton and Baldwin-Southwark 200 ton semi-automatic Transfer Molding presses. Thermal (La Rose) Preheaters. 2500 ton downstroke 54"x102". 300 ton multi-opening 40"x40". French Oil 250 ton 38"x28". Elmes 200 ton 28"x26". Farrel 200 ton 20"x80". 200 ton Hobbing Press. 200 ton 16" Record Presses. D&B 140 ton 36"x36". French Oil 120 ton self-contained. W.S. 120 ton 24"x24". Also Lab. Presses to 100 tons. Hydraulic Pumps and Accumulators. Van Dorn 1 and 2 ounce Injection Machines. Other sizes to 80 oz. Baker-Perkins and Day jacketed Mixers. Plastic Cutters. Oxford 57" Slitter. Seco 6"x13" and 8"x16" Mills and Calenders. Oil and Elect. Plastic Extruders, lab to 6". Single & Rotary Preform Presses ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107—8th Street, Brooklyn 15, New York.

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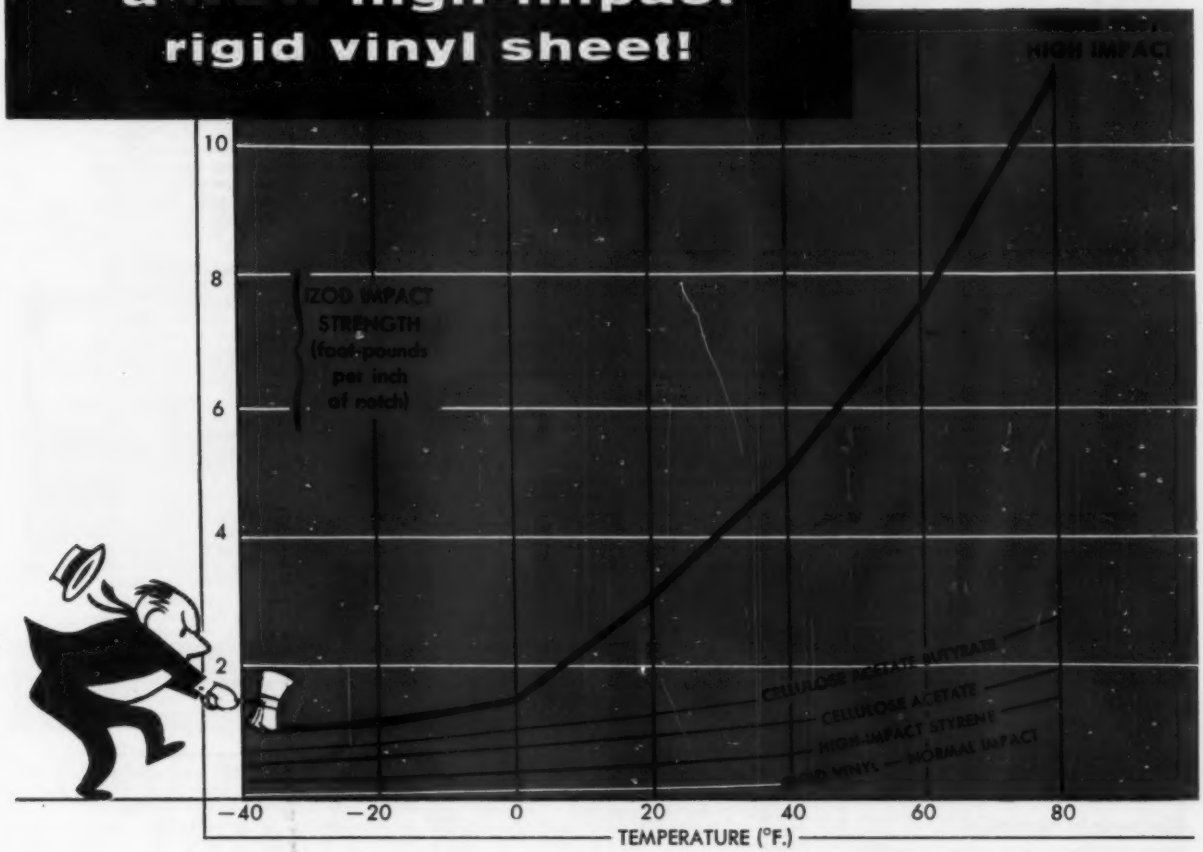
a NEW high-impact rigid vinyl sheet!



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Phone — New Brunswick Charter 9-1121, Metuchen Liberty 9-0200, New York Ext. WOrth 4-5290. **Chicago Office**, 510 No. Dearborn St., Michigan 2-2363. **St. Louis**, C. B. Judd, 3687 Market St., JEfferson 5-8082. **Cleveland**, E. H. Alexander, 20608 Kings Highway, Wyoming 1-2863. **Leominster, Mass.**, C. A. Dovidio, Phone 7-2120. **Canadian Distributor:** Crystal Glass & Plastics Ltd., 130 Queens Quay East, Toronto, Ontario.

(*Continued from page 278*)

JUST SECURED: Most Modern Packaging and Processing Machinery. Equipment installed within last 2 years. Available at great savings. 4—Hayssen Model F Compaks with net weight scales, bulk and dribble feeds, Electric Eyes. 4—Ceco Model 40-9½-GG Automatic Adjustable Cartoning Units. Also Model TT. 1—Pneumatic Scale Automatic Carton Feeder, Bottom Sealer and Top Sealer with interconnecting conveyors. 6—Fitzpatrick Model D-6 Stainless Steel Comminuters. 4—Day size G. 1500 lb. Ribbon type Powder Mixers. 2—Rietz Disintegrators Model RD18 complete with 50 HP motors. 1—Enterprise Foundry Disintegrators Model EVM3 complete with 50 HP motors. Complete Details and Quotations Promptly Submitted. Union Standard Equipment Company, 318-322 Lafayette St., New York 12, N. Y., Phone: Canal 6-5334.

Machinery wanted

WANTED: Two ounce Watson-Stillman vertical injection molding machine; also small powered transfer press 25-50 tons. DeBell & Richardson, Inc., Hazardville, Conn.

PREFORMER WANTED: Used but in good condition. Must be a Logan or Bipel. Write giving condition, age and price. Reply Box 3401, Modern Plastics.

WANTED: Spare Heating Chamber in good condition for 60 oz. H.P.M. Injection molding machine model 1000H60, Serial No. 50-71. Victory Manufacturing Corporation, 1722 West Arcade Place, Chicago, Illinois.

Materials for sale

FOR SALE: Nylon and other synthetic wastes, undrawn, fine and wiry, available in large quantities. For details call: MU 9-5780. Oscar Chandler & Co., Inc., 220 Fifth Avenue, New York 1, N. Y.

Materials wanted

WANTED:
Plastics Scrap and Rejects of all kinds. Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid. Reply Box 3400, Modern Plastics.

WILL PURCHASE: For cash, prime or off grade Styrene, Polyester Resin (any type), Cellophane or Acetate Film (min. 36" wide), glass cloth, Mat or Rovings, Pigments and catalysts. Reply Box 3414, Modern Plastics.

WANTED: Plastic scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 514 West 24th Street, New York 11, N. Y.

WANTED: Plastic of all kinds—virgin, reground, lumps sheet and reject parts. Highest prices paid for styrene, polyethylene, acetate, nylon, vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastic Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y., RAvenswood 1-0880.

ACETATE—BUTYRATE—ACRYLIC: All types of Plastic scrap waste, rejects, surplus in any form. We will call you to discuss prices applicable to your scrap as soon as you contact us. Claude P. Bamberger, Inc., One Mount Vernon Street, Ridgefield Park, N. J. Telephone: HUbbard 9-5330.

Molds for sale

FOR SALE: Houseware molds, comb molds, also some novelty and specialty items. All in excellent condition. No reasonable offer refused. Send for list. Reply Box 3407, Modern Plastics.

FOR SALE: A-1 condition Toy Molds for injection molding machine. Space Binocular Mold, Space men in action mold. Wonderful opportunity to cash in on todays toy market demand. Reasonably priced for quick sale. Reply Box 3406, Modern Plastics.

FOR SALE: Toy molds to produce, 1. Miniature toy furniture. 2. Play Iron, non-electric. 3. 7 inch car. 4. House trailer. All molds and dies in good condition. No reasonable offer refused. Reply Box 3425, Modern Plastics.

Molds wanted

WANTED: Injection molds—one item or complete line of proprietary consumer articles, also interested in molds for industrial parts such as knobs, handles, fasteners, boxes, etc. Will consider purchasing complete injection plant with end products or parts line. Designers: New items wanted—cash or royalty. Victory Mfg. Company, 1722 West Arcade Place, Chicago 12, Ill.—Estab. 1930.

WANTED TO BUY OR RENT: Injection molds for household brushes of all types. Complete line or single items considered. Reply Box 3405, Modern Plastics.

WANTED, HOUSEWARE MOLDS: Interested in purchasing houseware molds. Have injection machines up to sixty ounces. Reply Box 3408, Modern Plastics.

HOUSEWARE MOLDS WANTED: Specifically polyethylene pans of 1 to 4 quart capacity. Samples and details to Endicott-Seymour, P. O. Box 405, Ann Arbor, Michigan.

Help wanted

EXPERIENCED SUPERVISORY PRODUCTION PERSONNEL: For expanding fiberglass boat factory in Austin, Texas. Only top-notch men in lay-up and assembly will be considered. Experience, age, salary requirements, availability requested, first letter. Write R. R. Hammond, Glastron Boats, Box 9211, Austin, Texas.

IMPORTANT BRITISH POST: General Manager required by large English public company which is one of the leading manufacturers in the plastics and rubber industries. Successful applicant would be required to live in Midland Counties of England and would be responsible to the Board of Directors for the direction of all technical, administrative and commercial activities of large unit situated in that area. Candidates must possess good technical and commercial qualifications and must have extensive experience in general management at top level. Applications for this post, which is superannuable (i.e., leads to a pension), will be treated in complete confidence. Must include fullest personal and commercial particulars, including nature of appointments held, the names of at least two references, date available to commence and an indication of salary required. Initial interviews will be arranged in the U.S.A. Reply Box 3417, Modern Plastics.

GENERAL FOREMAN: Polyethylene Compounding. Have opening for top-notch man thoroughly familiar with processing scrap polyethylene into colors. Opportunity for future. Submit resume and salary expected. Reply Box 3421, Modern Plastics.

PLASTIC ENGINEER: To do products development work in new laboratory with expanding, well established proprietary manufacturing concern located in the Midwest. Work will cover broad range of industrial and household applications. Experience required in injection and compression molding plus general familiarity with thermoplastics and thermosetting compounds. Rubber compounding experience desirable but not essential. Future, salary open. Reply Box 3410, Modern Plastics.

ASSISTANT PLANT MANAGER: Expanding, well established Midwest company, manufacturing proprietary and custom molded plastics products, has an excellent opportunity for a young man who can qualify for a position as assistant Plant Manager. Position requires broad experience in plant supervision, administration, production planning, labor relations, etc., and a thorough knowledge of injection and compression molding equipment and materials. Salary open. Reply Box 3411, Modern Plastics.

PLASTIC ENGINEER—ESTIMATOR: Excellent opportunity for a qualified man to become associated with a Midwest company, manufacturing well established lines of proprietary plastic products, which is expanding its custom molding operation. This position requires a man to assist in mold design, estimate mold cost, price parts, and follow the job through molding and finishing of the part to customer acceptance. Position offers unlimited opportunity for future advancement. Starting salary open. Reply Box 3412, Modern Plastics.

SALES ENGINEER: To survey and promote markets for new types of film in both industrial and/or packaging applications. To consult with established and new customers in improved methods or techniques for using existing and new type films. A knowledge of packaging equipment essential. 3 to 5 years technical background preferred. Some travel involved. Send resume and salary requirements to R. W. Johnson. Celanese Corp. of America, 290 Ferry St., Newark, New Jersey.

PLASTIC ENGINEER: Molder of reinforced plastics plans to re-enter vacuum forming field, seeks young engineer with practical experience in forming thermoplastic sheet and with training and ability to set up sheet forming division. Reply, giving full particulars including salary requirement to—Personnel Mgr., Plastic Products Corp., Cleveland 22, Ohio.

PLASTICS AND RUBBER CHEMIST: To head laboratory of specialty chemical manufacturer expanding development of products. Duties will include development and presentation of new products including technical service functions on existing business. Present products are plasticizers, vinyl stabilizers, metallic soaps, and surface active chemicals. Reply Box 3404, Modern Plastics.

CHIEF ENGINEER FOR EUROPE: To supervise entire program of complex mold-making there. Read the full-page REVELL ad on page (254).

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PLANT SUPERINTENDENT: Injection molding-finishing. Must be top man with knowledge of tooling & estimating. Metropolitan New York. Progressive young company. Salary open. Reply Box 3419, Modern Plastics.

PERSONNEL: Executive—Technical—Sales—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill. —WAbash 2-4800. Call, write or wire—in confidence.

EXTRUSION FOREMAN: Opportunity to build up extrusion department as a new department in a large company. Captive market. Must have experience with all extrudable plastics, including saran. Capable of designing dies. Product mainly thin wall tubing. Replies confidential. Reply fully, stating detailed experience and salary requirements. Reply Box 3424, Modern Plastics.

VINYL SALES: Your previous experience in selling to the PVC consuming industry is of value to Escambia where sales effort is supported by an aggressive technical service and research organization. Interviews arranged at your convenience. Write to: Escambia Chemical Corporation, 261 Madison Avenue, New York 16, N.Y.

Situations wanted

MANUFACTURER' AGENT: Wishes plastic building specialties including polyethylene film and expandable foam products. Contacts with wholesale building suppliers, floor covering distributors, lumber yards, fabricators, building contractors, architects, etc. in State of Michigan. University graduate, good territory developer. Reply Box 3416, Modern Plastics.

1958 EUROPEAN COMMON MARKET: PHD (business mgmt. & chemistry), 31, broad plastics experience; bus. mgmt., sales, tech. service, production mgmt., process expert, excell. organizer, travelled, knows European markets, regul. tariffs, taxes, speaks French, German, Italian; desires to go abroad for US firm as liaison engr., sales repres., mgr. to run or set up branch not subject to rising tariffs. Reply Box 3402, Modern Plastics.

REINFORCED PLASTICS CONSULTANT: For assistance on your product and process development, engineering, production, and marketing problems. M.I.T. graduate in engineering and business with wide experience in all phases of reinforced plastics. Thorough knowledge of materials and processes. Reginald B. Stoops, 445 Park Avenue, New York 22, New York, Tel. MUrrayhill 8-3800.

CONSULTING ENGINEER: Takes over designing, installing and putting into operation especially of German Plastic Converting Machines such as dressing machines, calender stacks, extrusion presses, etc. for PVC and polyethylene sheets, PVC floor covering, pipes, flexible tubing, profiles, etc. And as well privity of foreign firms in Germany for machine technique. Reply Box 3403, Modern Plastics.

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FOR SALE: Approximately 350 sheets Celanese press polished Cellulose Acetate sheet .060" x 30" x 60" priced at $2.75 per sheet. Still in original cartons. Entire lot only. Fawn Plastics Co., Inc., 2301 York Road, Timonium, Maryland.

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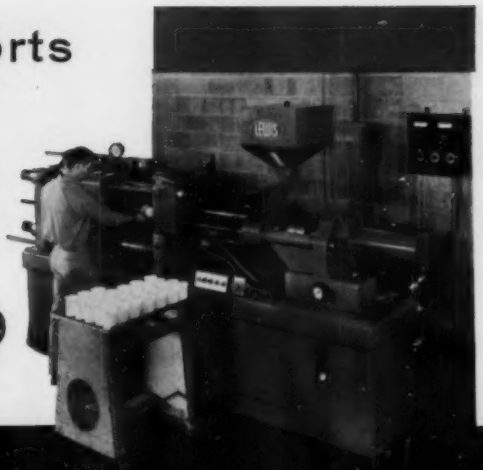

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